

CHAPTER 2. PHYSICAL DESCRIPTION OF MILWAUKEE COUNTY AND NATURAL RESOURCE INITIATIVES

This chapter presents a brief description of the geography, population, general climate, natural resource base, and land uses of Milwaukee County. It also details initiatives aimed at improving the County's natural resources.

2.1 GEOGRAPHY, POPULATION, CLIMATE, PHYSIOGRAPHIC FEATURES

Geography

Milwaukee County is located in the southeastern part of the state of Wisconsin and occupies approximately 155,064 acres. The city of Milwaukee is the county seat. Milwaukee County is bounded to the east by Lake Michigan, to the south by Racine County, to the west by Waukesha County and to the north by Ozaukee County.

Milwaukee County is approximately 90 miles north of the Chicago metropolitan area and has the largest airport in the state of Wisconsin. The county is served by Interstate highways 94 and 43 as well as the I-894 bypass, which connects to U.S. Highway 41/45. I-794 connects downtown Milwaukee to the airport service area. These transportation corridors link Milwaukee County to its neighboring counties as well as to other parts of the states of Wisconsin, Illinois, Minnesota and the Upper Peninsula of Michigan.

Population Size, Distribution, and Land Use

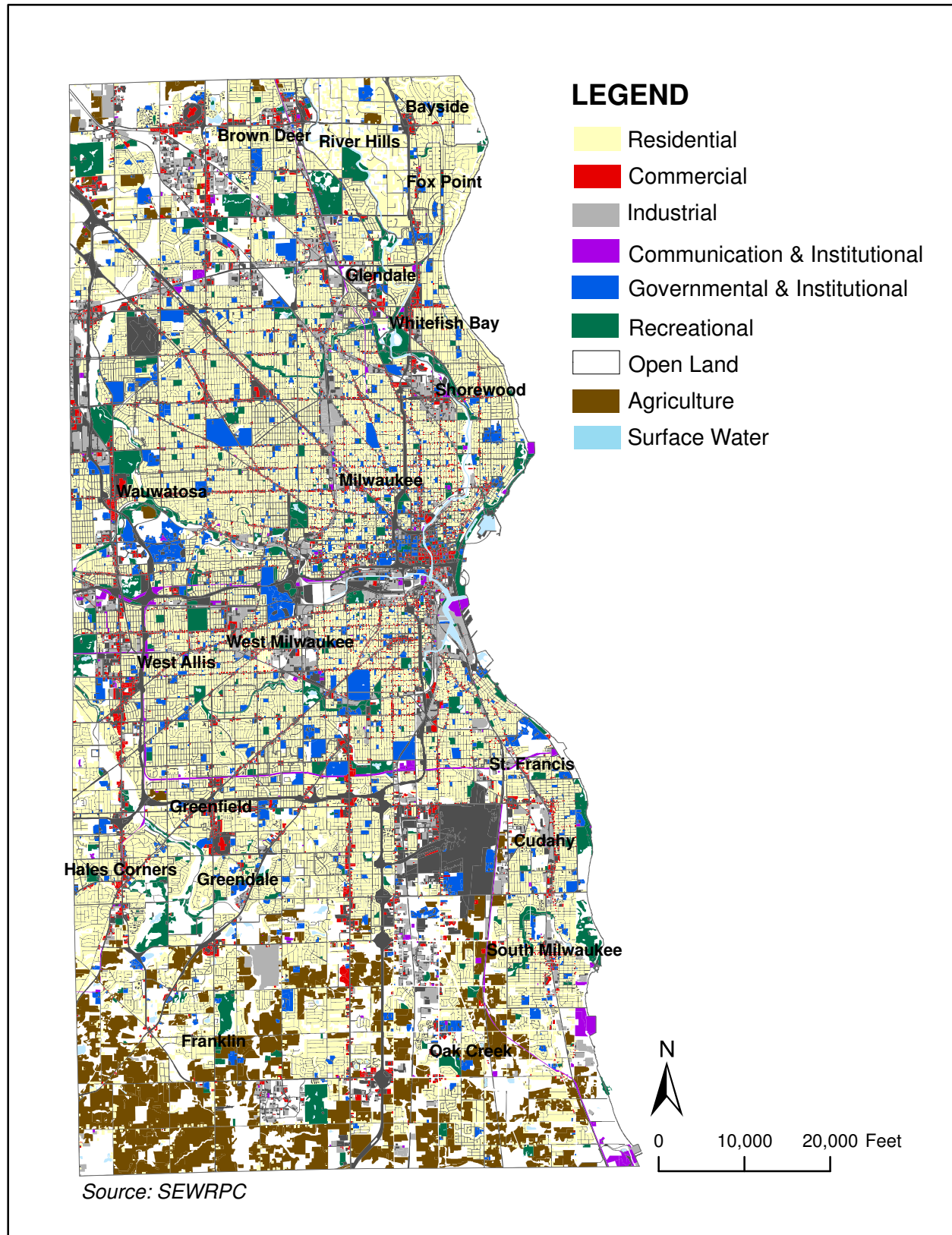
The size, composition and spatial distribution of the population profoundly influence the quantity and quality of the natural resource base of Milwaukee County. According to the 2000 Census, the resident population of Milwaukee County stood at 940,164 persons, which equates to 3,892 persons per square mile. Milwaukee County saw a population decrease of 2% from the 1990 census. For comparison, in 1900, Milwaukee County contained a resident population of about 330,017 persons.

The Southeastern Wisconsin Regional Planning Commission (SEWRPC) developed population projections under three regional growth scenarios, including the recommended Regional Land Use Plan for Southeastern Wisconsin: 2020; a high-growth decentralized plan; and a high-growth centralized plan. Under the 2020 recommended plan, Milwaukee County could experience a 6.6% increase in population by 2020. However, the population is declining at this time due to decentralization.

Although the population levels are slowly declining, land use is still subject to intensive pressures. For example, the major land uses in Milwaukee County in 2000 were residential (36%) and transportation (29%). Open land was the third largest land use, making up approximately 14% (Figure 1).

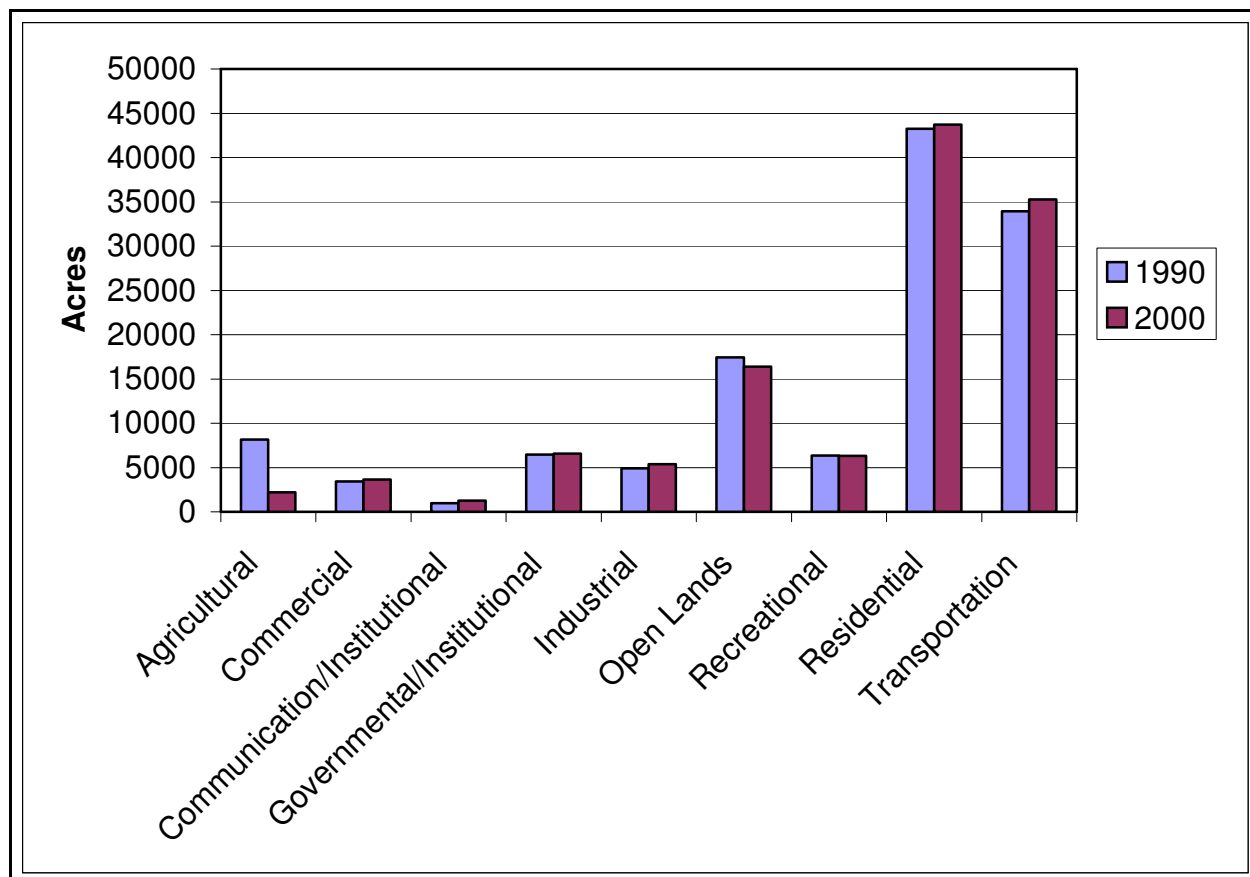
As of 2002, approximately 4.6% of Milwaukee County was used for farming, and only one dairy farm remained in the County. Most of the remaining farmland occurs in southern Milwaukee

FIGURE 1. LAND USE IN MILWAUKEE COUNTY (2000)



County, particularly in Franklin. The majority of the farmland in Milwaukee County is used to produce corn and soybeans.

FIGURE 2. LAND USE IN MILWAUKEE COUNTY (1990, 2000)



Climate

Weather has a profound influence on the growth and development of an area. Snow cover, temperature and rainfall affect the cost of building and maintaining structures and public facilities. Recreational interests are influenced by the local climatic conditions. Rainfall, temperature and length of the growing season determine the kinds of crops that can be produced in Milwaukee County.

Milwaukee County lies in the mid-continental zone, characterized by winters that are long and relatively cold and snowy. Summers are mostly warm with periods of hot humid conditions. Air temperatures are subject to extreme seasonal variations. July is the warmest month, and January the coldest. Snow cover is most likely during the months of December, January and February. Frost conditions usually occur from October to May. Streams and lakes begin to freeze over in late November, and ice breakup usually occurs in late March or early April.

The mean annual precipitation for the City of Milwaukee is approximately 31 inches. The majority of precipitation falls in the form of rain during the growing season, between May and September, when more than 14 inches may fall (about half of the average annual rainfall). Approximately 50 rainfall events occur per year. A rainfall event is defined as a distinct period when precipitation is equal to or greater than 0.1 inch. Runoff can be high during rainfall events in March, April and May. This is particularly true in the early spring when the ground is still frozen, the soil moisture is high and little infiltration occurs.

The average annual snowfall and sleet is 47.1 inches. Assuming that 10 inches of measured snow and sleet are equivalent to one inch of water, the average annual snowfall is equivalent to 4.7 inches of water or about 13 percent of the average annual precipitation.

Rainfall intensity, duration and frequency are major factors that affect the peak rate of runoff and flooding that occurs in Milwaukee County. The most intense type of storm is that which occurs within a 24-hour duration with the most intense rainfall occurring during a six-hour period near the middle of the duration. The size of a storm is often described by the length of time the precipitation occurred, the total amount of precipitation that occurred, and how often this same storm level occurs.

Physiographic Features

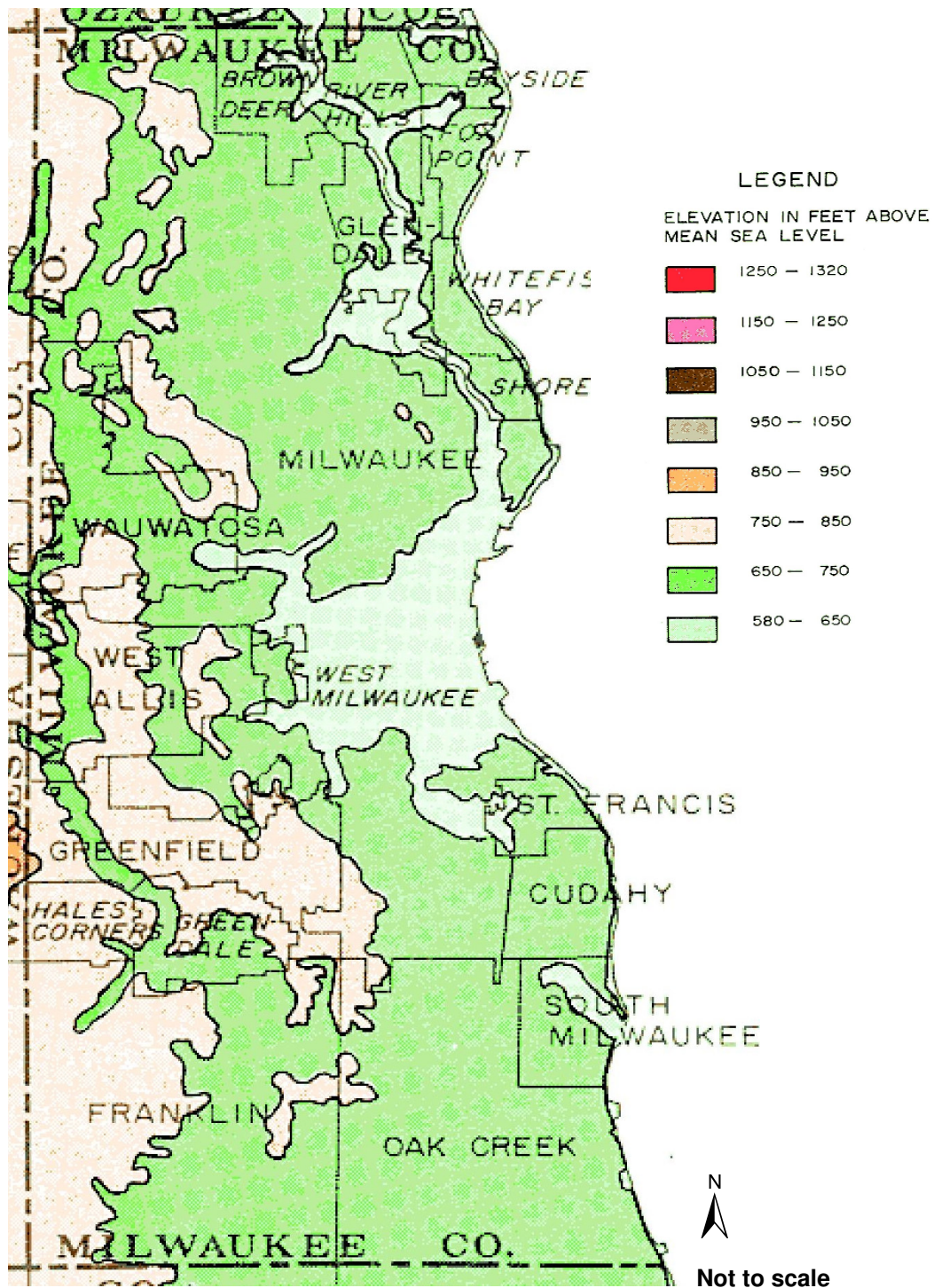
The four major stages of glaciation that occurred in the southeast region of Wisconsin laid the foundation for the physiology, topography and soils of Milwaukee County. The last and most influential stage of glaciation was the Wisconsin stage that is said to have ended in Wisconsin about 11,000 years ago.

The glacier movement and deposition caused a derangement of surface drainage in the areas it covered. As a result of some of this former glacial activity, large areas of Milwaukee County were covered with wetlands prior to urban development.

Other areas of Milwaukee County consist of gently rolling land. A steep escarpment is also present along the Lake Michigan boundary at the north and south ends of the county, away from the mouths of the Milwaukee, Menomonee and Kinnickinnic Rivers.

Topography and drainage patterns are considered in all aspects of land use and resource management planning. Topographic features have a direct influence on the potential for soil erosion and sediment movement and deposition. Sloping land under cultivation or construction is much more likely to impact surface water quality when used without soil conservation practices or runoff management controls.

FIGURE 3: TOPOGRAPHIC FEATURES OF MILWAUKEE COUNTY



Source: SEWRPC

Surface Drainage

Surface waters of Milwaukee County flow to Lake Michigan through five watersheds covering approximately 237 square miles. The watersheds include:

- The Milwaukee River (South)
- The Menomonee River
- The Kinnickinnic River
- Oak Creek, and
- The Root River

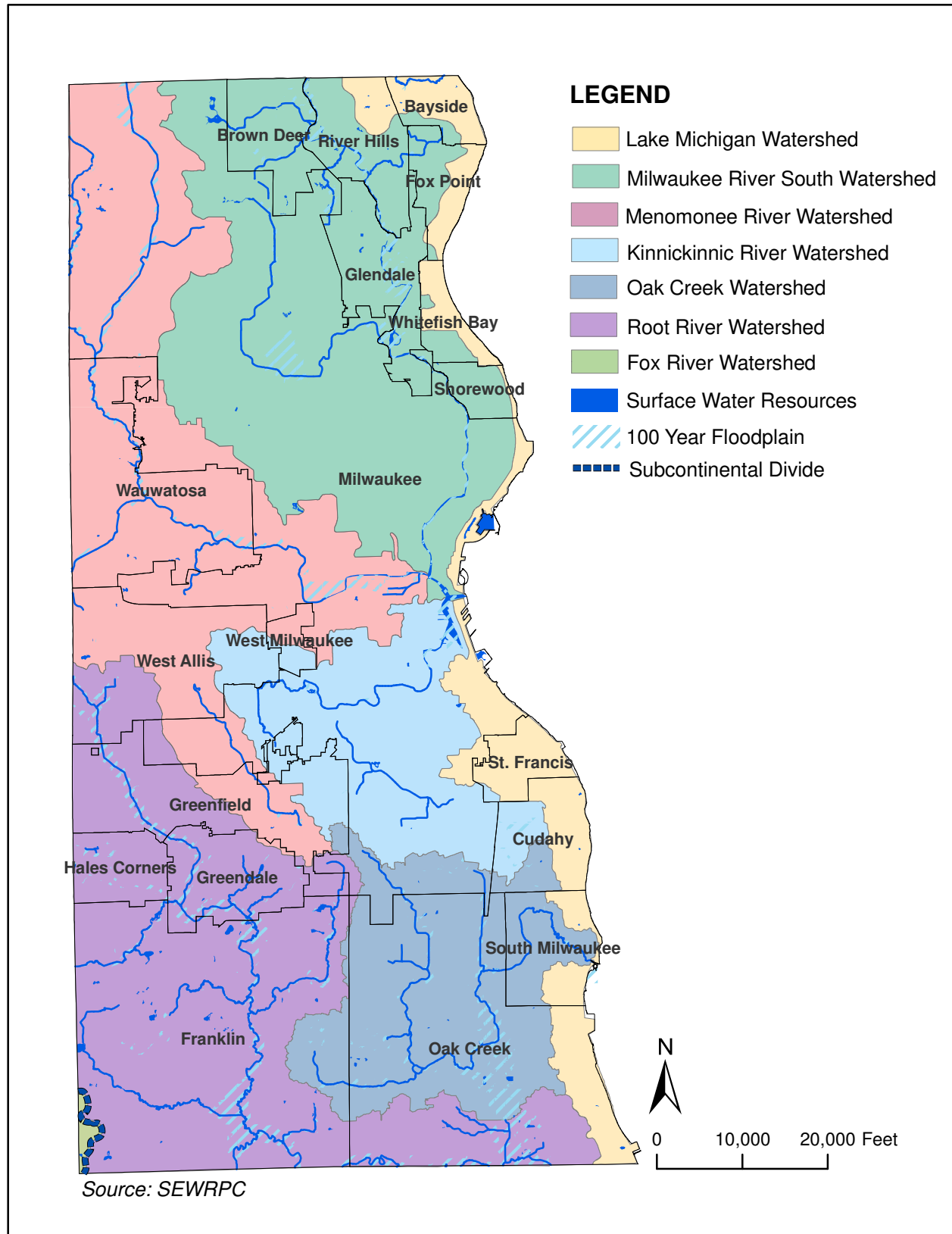
The watersheds and floodlands of the region are shown in Figure 4.

All five of the watersheds drain directly to Lake Michigan. The Milwaukee River, the Menomonee River and the Kinnickinnic River empty into Lake Michigan at the Milwaukee harbor. Oak Creek empties into Lake Michigan in South Milwaukee near Grant Park. The Root River empties into Lake Michigan at the City of Racine.

The surface drainage in Milwaukee County ranges from well-developed dendritic patterns produced on permeable unconsolidated materials present over sedimentary bedrock to a deranged pattern characteristic of drainage formed in glacial deposits that have blocked the previous natural flow paths. The result of the glaciers in Milwaukee County was to produce a large area of low flow and swamp-like conditions.

The low flow conditions in the river (primarily the Milwaukee River) have been modified by the placement of a series of dams in the river. The swampy areas were developed in the late 1800's and were located in the area of the downtown portion of the City of Milwaukee.

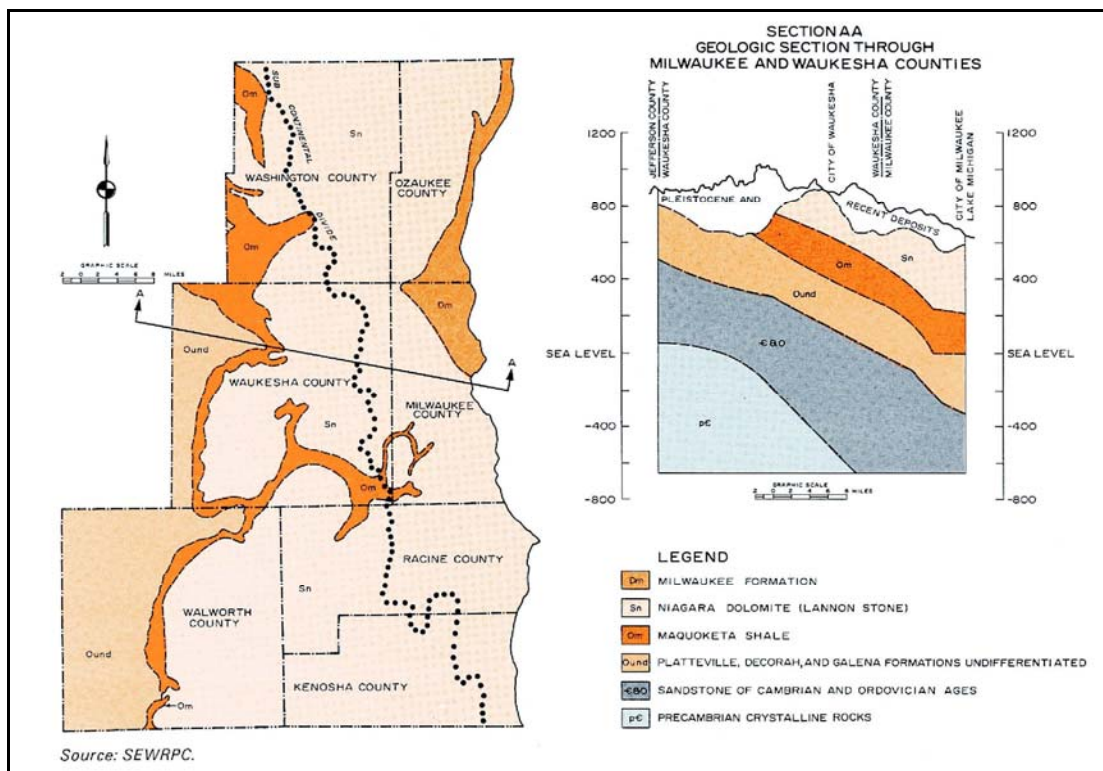
FIGURE 4. WATERSHEDS AND SURFACE WATER RESOURCES IN MILWAUKEE COUNTY



2.2 GEOLOGY AND SOILS

The bedrock formations underlying the unconsolidated surface deposits of Milwaukee County consist of Niagara Dolomite of Silurian-age. Below the Niagara formation are the Maquoketa shale, the Platteville, Decorah, and Galena formations (primarily limestones or dolomites) and sandstones of Ordovician-age. Additional sandstones of Cambrian-age underlie the Ordovician-age formations.

FIGURE 5: MAP AND CROSS-SECTION OF BEDROCK GEOLOGY IN SOUTHEAST WISCONSIN



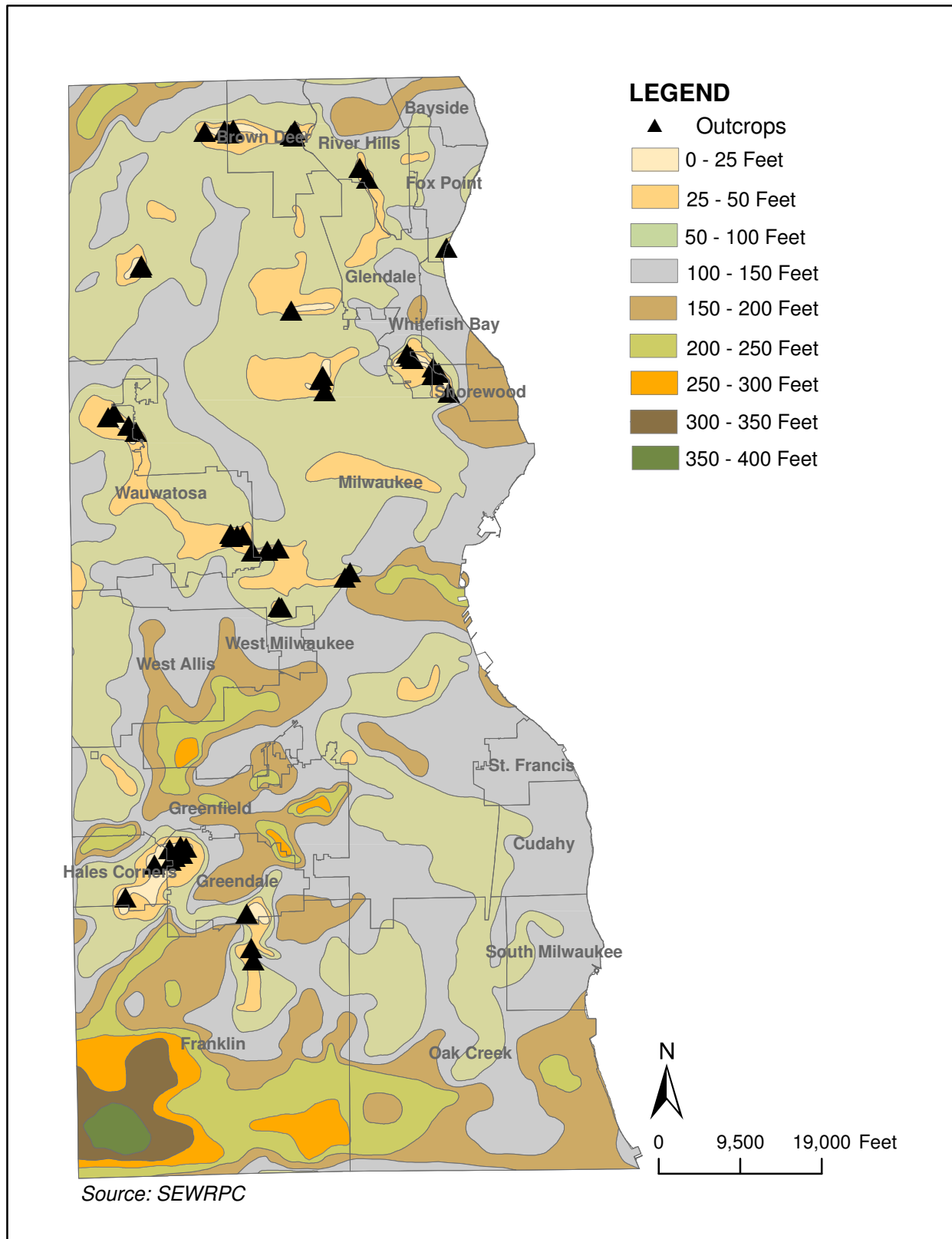
The bedrock of Milwaukee County is primarily covered by deep, unconsolidated glacial deposits, attaining thickness in excess of 500 feet in some buried pre-glacial valleys. Bedrock lies within 20 feet of the ground surface in some areas of Milwaukee County (see Figure 6).

Mineral And Organic Resources

Milwaukee County had a ready supply of commercially attractive sand and gravel deposits because of the glacial history of the area. Many of these available resources have been used to the extent possible and the land long since converted to other uses, such as parkland.

Organic deposits are present in Milwaukee County and are found on low-lying, poorly drained areas. Organic deposits have environmental value by supporting diverse biological plant and animal communities. Many areas of organic deposits are included in environmental corridors associated with drainageways of the various river systems in Milwaukee County.

FIGURE 6. THICKNESS OF GLACIAL DEPOSITS AND LOCATION OF BEDROCK OUTCROPS



Soils

The soil is a valuable and irreplaceable natural resource. It serves as the foundation for all human, animal and plant activities. Soil properties influence land use; they can be impacted by changes in land use.

The soils in Milwaukee County range from very poorly drained organic soils to well drained sandy or loamy soils. Six soil associations (Figure 7) are found in the County, as identified by the U. S. Department of Agriculture, Natural Resource Conservation Service (NRCS). A soil association is defined as a landscape having a distinctive proportional pattern of soils. An association is typically comprised of one or more major soil types and at least one minor soil type, and is named after the major soil types. A description of the soil associations in Milwaukee County, along with their distribution within the County, is presented in the figure showing Generalized Soil Association Groups in the Region.

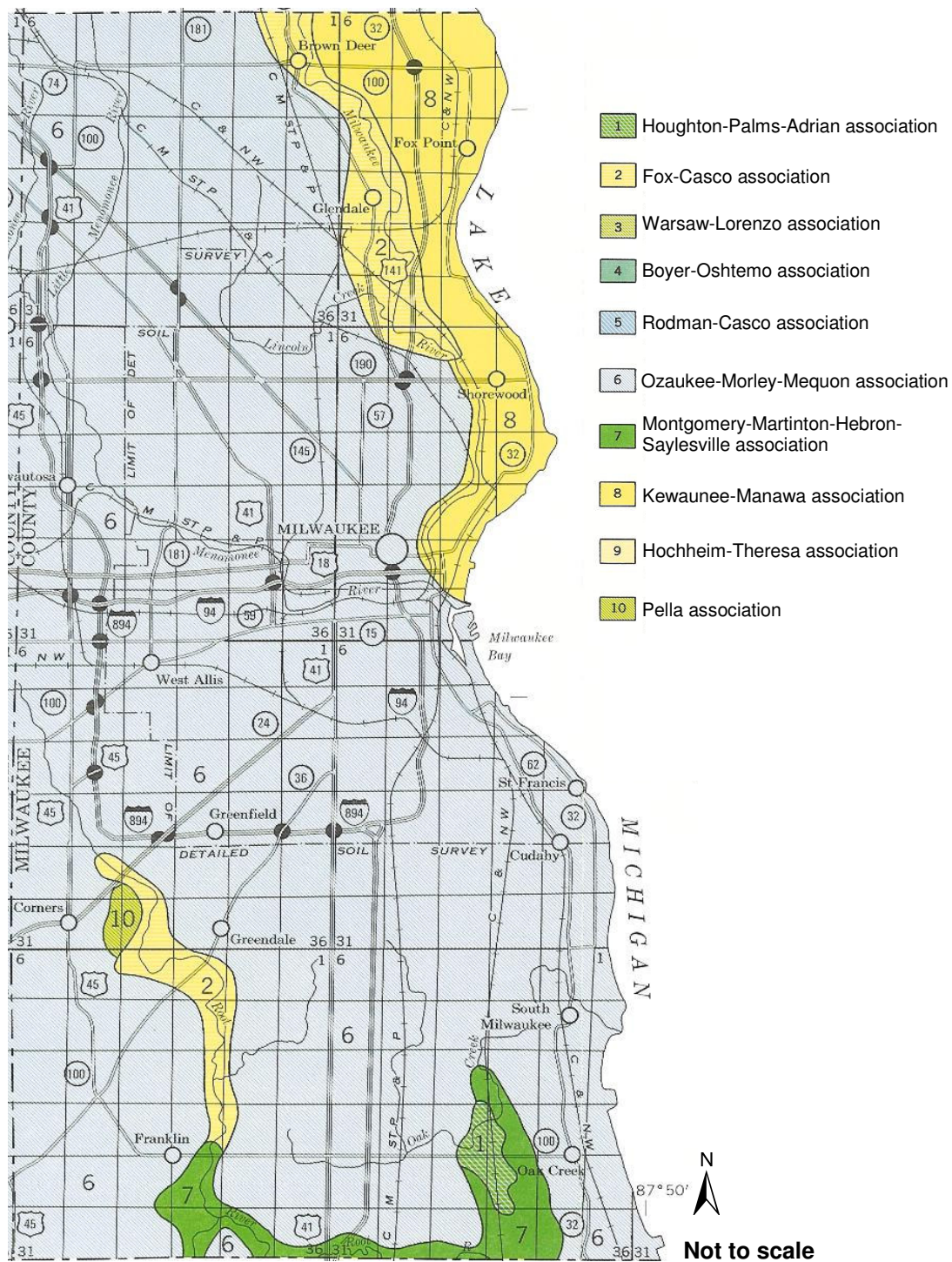
Soil Erosion Potential and Relative Soil Loss

Soils vary in their potential to erode, due primarily to differences in physical characteristics, including soil texture, soil structure, organic matter, and permeability. In order to provide insight into the potential for soil erosion in Milwaukee County, the soils of the County have been categorized as having slight, moderate, and severe erosion potential, and mapped accordingly.

The rating for each soil is based upon its capability class and subclass as assigned under the U.S. Soil Conservation Service agricultural land capability system. The rating indicates the potential for both water and wind erosion. It is emphasized that the rating is based solely on soil characteristics that affect a soil's response to management and treatment. Farming practices, which have a direct bearing on the rates of erosion, are not taken into account. The rating for erosion potential and other soil characteristics for the soils of Milwaukee County are discussed in detail in the *Soil Survey of Milwaukee and Waukesha Counties*, prepared by the U.S. Soil Conservation Service, issued January 1998.

Based on a transect survey conducted in 2002, the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) reported that the average relative soil loss for Milwaukee County is about 2.61 tons per acre. This number is down from the average relative soil loss calculated in 1999 (4.1 tons per acre). A copy of the transect survey is attached (Appendix 2).

FIGURE 7: SOIL ASSOCIATIONS IN MILWAUKEE COUNTY



Source: NRCS Soil Survey of Waukesha and Milwaukee Counties, 1970

2.3 WOODLANDS, WETLANDS, ENVIRONMENTAL CORRIDORS

Woodlands

Woodlands have both economic and ecological value, and under good management can serve a variety of uses providing multiple benefits. Located primarily on ridges and slopes and along streams and lakeshores, woodlands provide an attractive natural resource of immeasurable value.

Woodlands should be maintained for their total values – scenic, wildlife, educational, recreational, and watershed protection – as well as for their forest products. Under balanced use and sustained yield management, woodlands serve many of these benefits simultaneously.

In 1963, Milwaukee County reported about 5,467 acres of woodland remaining. This was about 3.5% of the total rural land use in the County. In 1980, approximately 4,856 acres of woodlands and woody wildlife cover were recorded within Primary and Secondary environmental corridors and within designated isolated natural resource areas of Milwaukee County.

In 2000, approximately 2,639 acres of woodland remained (or about 2.18% of land use; Figure 8).

Wetlands

Wetland areas provide one of the most important landscape features of an area, and can serve to enhance proximate uses. Their contribution to resource conservation and recreation is immeasurable. Wetlands may be found in lake and pond basins, cropland and wooded low-lying depressions that may only hold water for short periods during the growing season, or along stream and river floodplains. Wetlands may be described as areas in which the water table is at or near the land surface. Such areas are typically unsuited or poorly suited for most agricultural or urban development purposes.

Wetlands perform many important environmental functions, including improving surface and ground-water water quality, minimizing and buffering flood damage, and providing a wide range of habitat for both common and rare plant and animal species.

Wetlands contribute to flood control and water quality enhancement, since such areas naturally serve to store excess runoff temporarily, and thereby tend to reduce peak flood flows and to trap sediments, nutrients, and other water pollutants. It has been found that except during periods of unusually high runoff, concentrations of nutrients in waters wetlands are considerably lower than in waters entering the wetlands.

Recognizing the many environmental attributes of wetlands, continued effort should be made to protect these resources by discouraging costly wetland draining and filling caused by urbanization. A great deal of valuable wetland has been lost in recent years.

FIGURE 8. WOODLANDS IN MILWAUKEE COUNTY (2000)

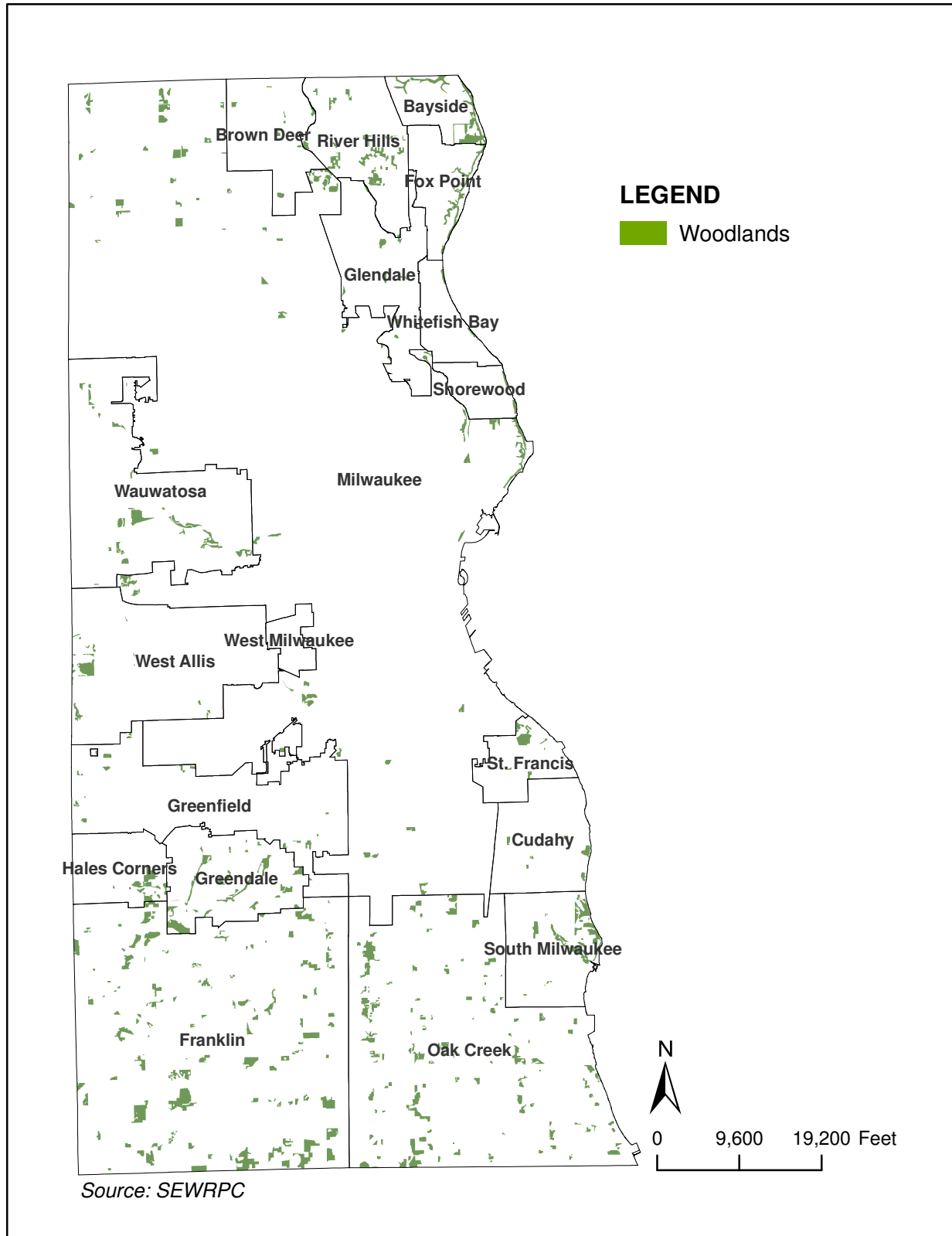
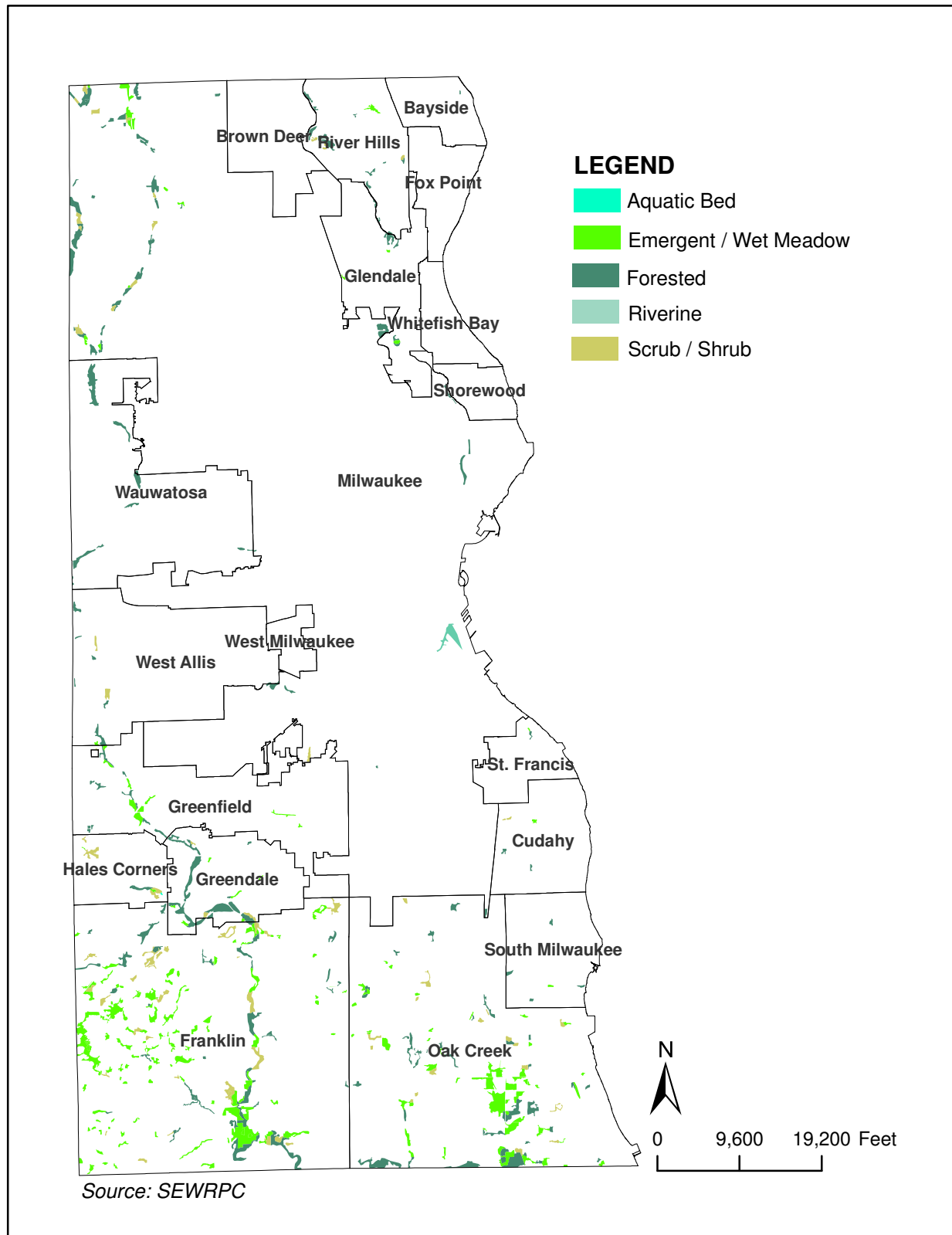


FIGURE 9. TYPES OF WETLANDS IN MILWAUKEE COUNTY (2000)



In the 1980's, approximately 4,038 acres of wetlands were designated for protection. These wetlands were located within Primary and Secondary Environmental Corridors. Another 455 acres were located within designated isolated natural resource areas of Milwaukee County. In 2000, approximately 1,955 acres of wetland remained (or about 1.62% of land use). The types and distribution of wetlands within Milwaukee County in 2000 are depicted on Figure 9.

Wildlife Resources

The woodlands, wetlands, grasslands, lakes, rivers, and streams result in good wildlife diversity in Milwaukee County. Many migratory birds can be seen throughout the county at various times of the year and are especially noticeable along the Lake Michigan Shoreline. Diversity of wildlife in Milwaukee County contributes to a healthy ecosystem and provides valuable recreational opportunities.

Generally, populations of urban wildlife, including raccoon, coyote, deer and Canada geese, are increasing rapidly. Control measures are increasingly needed to reduce damages caused by such wildlife. For example, due to excessive aggregation along waterways and ponds, goose droppings are becoming both an environmental as well as a public health hazard. Mowed grass adjacent to water bodies encourages the congregation of large numbers of geese because the short grass allows the geese to easily see predators while they feed on the grass, allowing them quick access to water for protection. Buffers planted with taller, native plants are one method being used to discourage geese. The taller vegetation reduces the ability of the geese to see predators while they feed, making the area less desirable.

Environmental Corridors and Natural Areas

Areas of the region having natural areas with recreational, historic, aesthetic, and scenic resources should be preserved and protected in order to maintain the overall quality of the environment. Milwaukee County citizens are interested in protecting areas having biologically rich assemblages of plants and animals; unique geological features (such as bluffs); endangered, threatened and rare species; archeological and cultural resources; significant scenic views; and mature or old growth forests. Milwaukee County citizens are also interested in public parklands in close proximity to population centers, since there is less time and fewer costs involved in travel.

The Southeastern Wisconsin Regional Planning Commission (SEWRPC) adopted a Regional Park and Open Space Plan in 1977. Under the planning program, a series of inventories were conducted including land use; areas with steep and rough topography; natural resource base (wetlands, woodlands, wildlife habitat); and potential park sites. Open space preservation, acquisition and development objectives were also set forth.

The open space preservation plan recommended the acquisition of about 1,170 acres of primary environmental corridor land and another 830 acres of additional park lands for inclusion in the Milwaukee County park system. About 6,300 acres of prime agricultural land (mostly in Franklin) was recommended to stay in such use.

Milwaukee County later compiled inventory information regarding Milwaukee County parks, natural areas and environmental corridor system and reported the findings in a Park and Open Space Plan for Milwaukee County (issued 1991). By 1990, Milwaukee County Parks and Parkways totaled 14,725 acres (or about 9% of the total area of Milwaukee County). Of that acreage, 7,217 acres (128 sites) were parks in county ownership. About 89 miles of biking facilities were present by 1987, primarily along environmental corridors in parkway systems. An updated Park and Open Space Plan for Milwaukee County is expected to be available in Spring 2006.

A special category of natural area, encompassing the thirty-mile Lake Michigan shoreline within Milwaukee County, is discussed separately below because of the unique natural conditions that necessitate more intensive planning and conservation.

Primary Environmental Corridors

The primary environmental corridors of Milwaukee County generally lie along major stream valleys and around major lakes, and contain almost all of the remaining high-value woodlands, wetlands, and wildlife habitat areas within the County. It also contains all of the major bodies of surface water and associated undeveloped floodplains and shorelands. These primary environmental corridors are, in effect, a composite of the best individual elements of the natural resource base of Milwaukee County, and have immeasurable environmental and recreational value.

In addition to their recreational value, many environmental corridors offer ecological benefits. Populations of species, for example, can take better advantage of exchanging genetic material more frequently, improving genetic diversity and overall health.

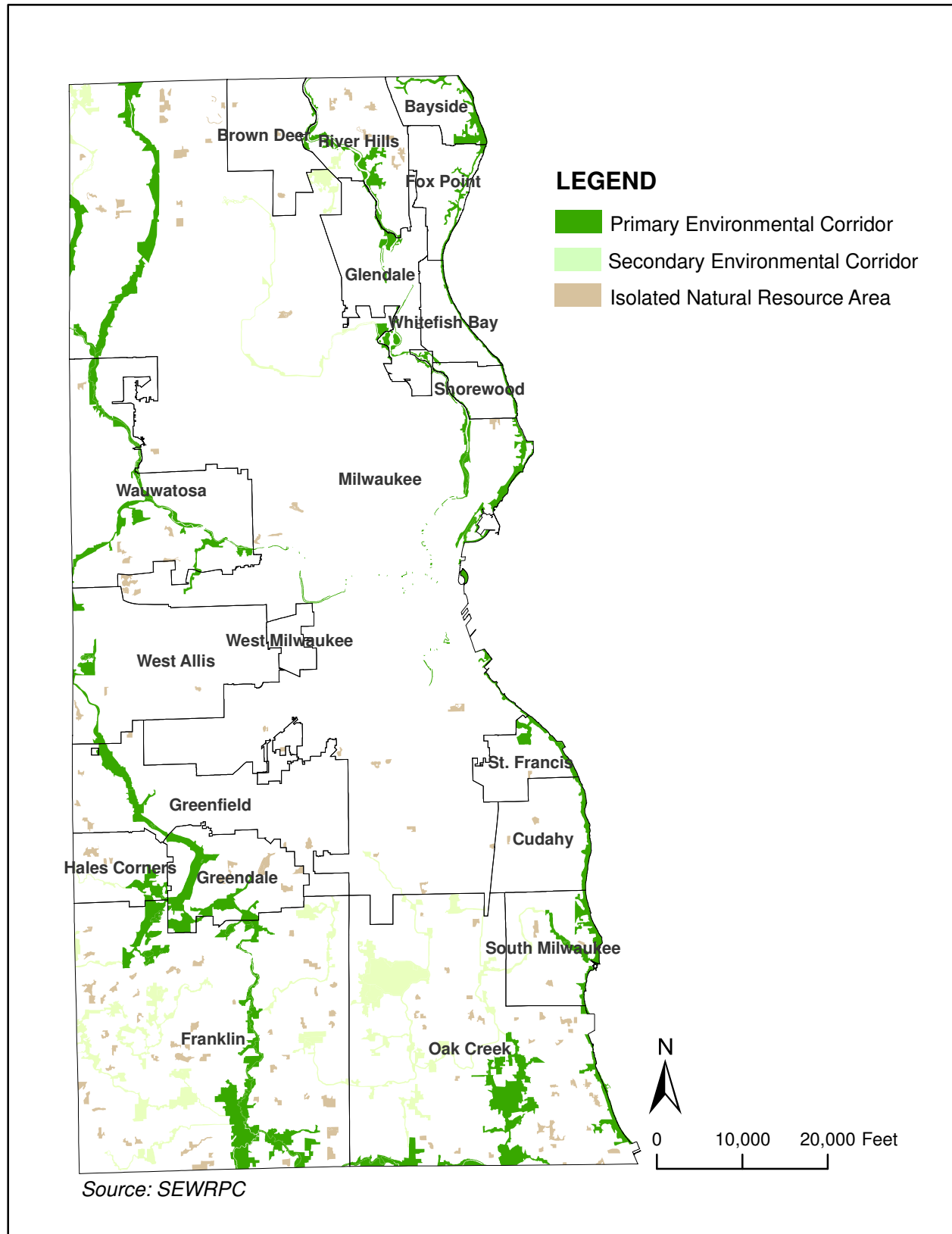
Primary corridors may be subject to urban encroachment because of their desirable natural resource amenities. Poorly planned intrusion of urban development into these corridors tends to destroy the very resources and related amenities sought by the development, and often creates severe environmental and developmental problems. In 2000, primary environmental corridors (including surface water, wetlands, and woodlands) in Milwaukee County comprised 8,599 acres; this is down from 9,726 acres of primary corridors in Milwaukee County in 1980.

Secondary Environmental Corridors

The secondary environmental corridors in Milwaukee County are located generally along intermittent streams, or are designated because they serve as links between segments of primary environmental corridors. These secondary environmental corridors contain a variety of resource elements, including remnant resources from primary environmental corridors that have been lost to intensive agricultural purposes or urban land uses.

Secondary environmental corridors facilitate surface water drainage, maintain “pockets” of natural resource features, and provide for the movement of wildlife, as well as for the movement and dispersal of seeds for a variety of plant species. Such corridors should be preserved in natural uses as urban development moves forward within the County. In 2000, secondary environmental corridors (including surface water, wetlands, and woodlands) in Milwaukee

FIGURE 10. ENVIRONMENTAL CORRIDORS AND ISOLATED NATURAL RESOURCE AREAS



County comprised 3,630 acres; this is up from 3,451 acres of secondary corridors in Milwaukee County in 1980.

Natural Areas Acquisition, Restoration, and Management

A 1986 study by the Wisconsin Department of Natural Resources, Bureau of Endangered Resources found that the major pre-settlement plant communities in the southeastern portion of the state, including the original forest, prairie, oak savannah, and sedge meadow (wetlands) had been severely degraded or lost. Due to urbanization, many habitat types—and the plant and animal species dependent on them—have been eliminated.

In December 1987, Milwaukee County requested that the Southeastern Wisconsin Regional Planning Commission (SEWRPC) assist the County in development of criteria that could be used to evaluate county parklands and environmentally sensitive areas and provide standards for the management of such areas, once acquired for protection. *A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, Southeastern Wisconsin Regional Planning Commission, Planning Report No. 42* (issued September 1997) describes the quality and characteristics of natural areas identified in Milwaukee County (Figure 12 and Table 2).

MILWAUKEE COUNTY TRAILS AND NATURAL AREAS CREW

Management of the natural areas within Milwaukee County occurs from a collaboration of efforts by the Milwaukee County Parks Department and volunteer groups. The Trails and



Ravine stabilization efforts at Lake Park.

Natural Areas Crew (the Crew), a collection of County staff, was formed in 2005 in order to assist regional Milwaukee County Parks staff with the management of approximately 7,500 acres of natural areas owned by the County and maintenance of the Oak Leaf Trail and other Milwaukee County trails. The majority of the areas that the Crew manages occurs within primary and secondary environmental corridors and is degraded by a variety of invasive species. The Crew controls invasive species within the natural areas using methods such herbicide treatments and prescribed burning.

Native plants are installed following invasive species removal in order to enhance the floral community. The Crew also coordinates volunteer efforts to manage natural areas within County parks. Volunteer organizations, including the Weed Out! Program, play a vital role in providing the necessary manpower to control large stands of invasive species.

FIGURE 11. PRE-SETTLEMENT VEGETATION IN MILWAUKEE COUNTY

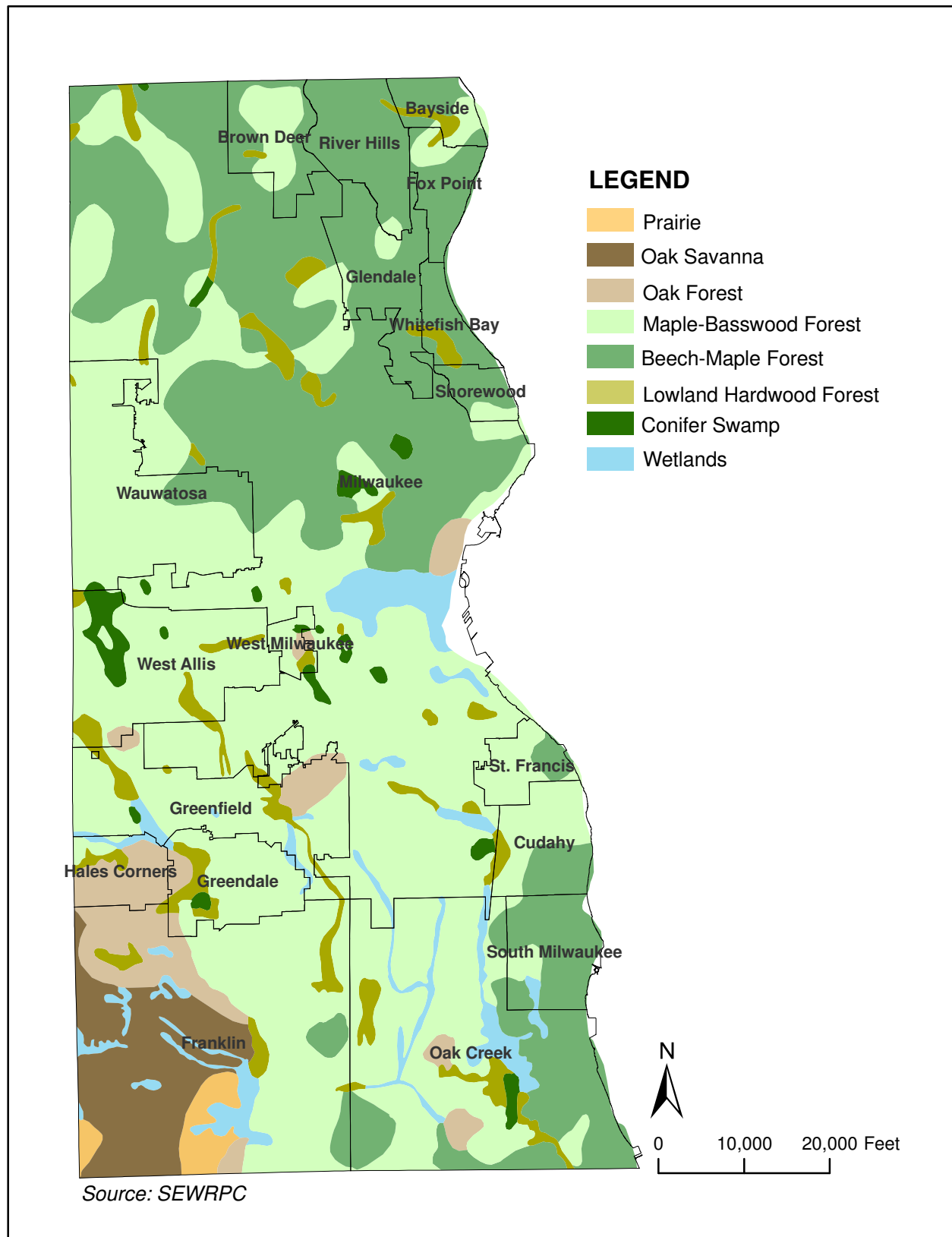


FIGURE 12: KNOWN NATURAL AREAS IN MILWAUKEE COUNTY (1994)

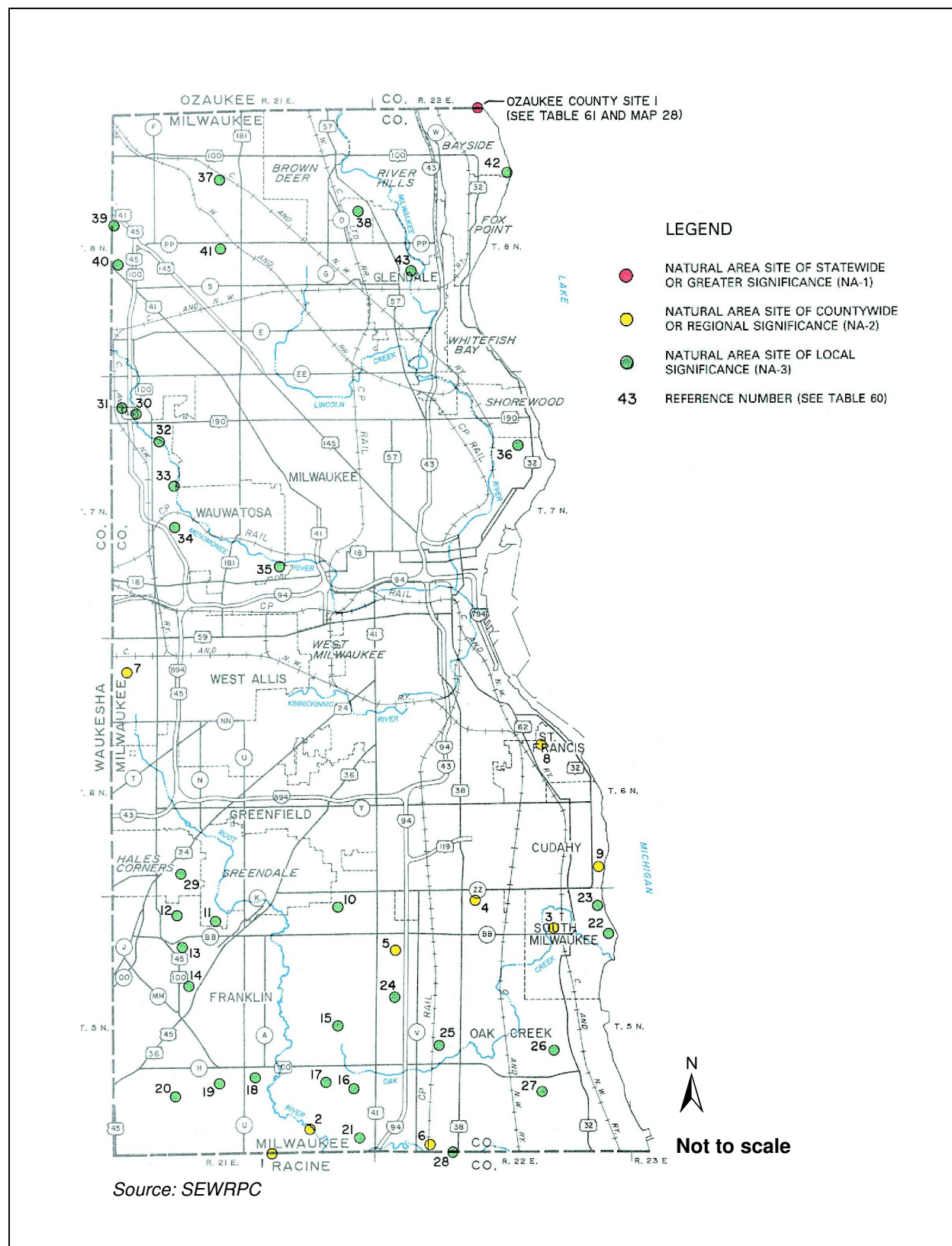


TABLE 2. KNOWN NATURAL AREAS IN MILWAUKEE COUNTY (1994)

Reference Number	Area Name	Classification Code	Location	Ownership	Size (acres)	Description and Comments
1	Root River Canal Woods	NA-2 (RSH)	T5N, R21E, Section 34, City of Franklin; T4N, R21E, Section 3, Town of Raymond	Milwaukee County and private	121 (plus 158 in Racine County)	A mixture of good-quality dry-mesic and lowland hardwood forest along the Root River Canal. One of the largest intact forested tracts in this part of the Region. Extends south into Racine County.
2	Root River Wet-Mesic Woods—West	NA-2 (RSH)	T5N, R21E, Sections 35, 36, City of Franklin	Milwaukee County and private	260	Mixture of medium-aged lowland and upland hardwoods that is recovering well from past disturbance. The ground flora is particularly rich and diverse, including good populations of several rare species. This is an important part of the Root River environmental corridor.
3	Rawson Park Woods	NA-2 (RSH)	T5N, R22E, Section 2, City of South Milwaukee	Milwaukee County and City of Milwaukee	23	Despite heavy human use, especially from the adjacent high school, this site contains probably the best remaining example of beech-maple forest in Milwaukee County. The north half is in best condition. The rich ground flora contains a good population of blue-stemmed goldenrod (<i>Solidago caesia</i>), a State-designated endangered species.
4	Cudahy Woods	NA-2 (RSH)	T5N, R22E, Section 4, City of Oak Creek	Milwaukee County	47	An upland hardwood forest containing two major forest types separated by a small stream. To the north is a dry-mesic forest of oak, cherry, and hickory; southward is an old-growth mesic forest of sugar maple, beech, and red oak. One of the best forests of its kind in the vicinity; there is a history of past scientific research.
5	Falk Park Woods	NA-2 (RSH)	T5N, R22E, Section 7, City of Oak Creek	Milwaukee County and private	77	This is a diverse, relatively large north-south stand of woods. Consists mostly of good-quality dry-mesic uplands, with mesic stands of beech and sugar maple at the north end, and low areas of ephemeral ponds, wet-mesic hardwoods, and stream interspersed throughout. Past disturbances appear minimal.
6	Root River Wet-Mesic Woods—East	NA-2 (RSH)	T5N, R22E, Section 32, City of Oak Creek; T4N, R22E, Section 5, Town of Caledonia	Milwaukee and Racine County	50 (plus 2 in Racine County)	Wet-mesic and mesic woods bordering a gavel-bottom stream that is a tributary of the Root River. Contains a rich, diverse flora, including several rare species.
7	Greenfield Park Woods	NA-2 (RSH)	T6N, R21E, Section 6, City of West Allis	Milwaukee County	52	A good stand of southern dry-mesic hardwoods dominated by red and white oaks, sugar maple, and basswood. Includes ephemeral ponds and a lowland hardwood swamp.
8	St. Francis Seminary Woods	NA-2 (RSH)	T6N, R22E, Sections 14, 15, City of St. Francis	St. Francis Seminary	37	This southern mesic forest features mature basswood, sugar maple, beech, red oak, and paper birch. The site is divided by a gravel road, a small stream tributary to Lake Michigan, and numerous trails. The relatively diverse ground flora includes the State-designated endangered blue-stemmed goldenrod (<i>Solidago caesia</i>).
9	Warnimont Park Fens	NA-2 (RSH)	T6N, R22E, Section 36, City of Cudahy	Milwaukee County	2	Clay bluffs with spring seepage along Lake Michigan support calcareous fens which contain an unusual flora. Regionally uncommon plants include buffaloberry (<i>Shepherdia canadensis</i>), variegated scouring-rush (<i>Equisetum variegatum</i>), purple false oats (<i>Trisetum melicoides</i>), Ohio goldenrod (<i>Solidago ohioensis</i>), small fringed gentian (<i>Gentiana procera</i>), and false asphodel (<i>Tofieldia glutinosa</i>), a State-designated threatened species.
10	Grobschmidt Park Wetlands and Upland Woods	NA-3 (RSH)	T5N, R21E, Sections 1, 2, City of Franklin	Milwaukee County and private	80	A combination of moderate-quality deep and shallow marsh, sedge meadow, shrub-carr, and disturbed dry-mesic woods. Site contains a restored prairie.
11	Root River Parkway Woods	NA-3 (RSH)	T5N, R21E, Section 4, Village of Greendale	Milwaukee County	53	Dry-mesic forest on undulating topography, dominated by relatively large red oaks. Ground layer is sparse. The woods contains hiking and ski trails.

12	Whitnall Park Woods—South	NA-3 (RSH)	T5N, R21E, sections 5, 8, City of Franklin; T6N, R21E, Section 32, Village of Hales Corners	Milwaukee County and private	137	Site consists of several more-or-less connected stands of dry-mesic upland woods. The area of highest quality is surrounded by golf links. Here, mature red oaks and sugar maples provide a canopy over a representative ground flora that includes two State-designated special concern species: American gromwell (<i>Lithospermum latifolium</i>) and black haw (<i>Viburnum prunifolium</i>).
13	Monastery Lake Wetlands	NA-3 (RSH)	T5N, R21E, Section 8, City of Franklin	Nature Foundation and private	45	A diverse wetland plant community complex consisting of deep and shallow marsh, sedge meadow, fresh (wet) meadow, shrub-carr, and the last surviving tamaracks in Milwaukee County.
14	Mission Hills Wetlands	NA-3 (RSH)	T5N, R21E, Sections 16, 17, City of Franklin	Private	38	Complex of sedge meadow, shallow marsh, and wet prairie
15	Franklin (Puetz Road) Woods	NA-3 (RSH)	T5N, R21E, Sections 23, 24, City of Franklin	Wisconsin Department of Transportation	28	Situated along the headwaters of Oak Creek, this site consists of mature dry-mesic hardwoods, lowland hardwoods, and stands of younger growth. The rich and diverse flora includes black haw (<i>Viburnum prunifolium</i>), a State-designated special concern species.
16	Fitzsimmons Road Woods	NA-3 (RSH)	T5N, R21E, Section 25, City of Franklin	Milwaukee County and private	42	The south and east portions of this dry-mesic woods are mostly second-growth; the west portion is less disturbed, with larger, mature trees. In the northwest are several ephemeral ponds where the State-designated endangered hoplike sedge (<i>Carex lupuliformis</i>) is found.
17	Oakwood Park Oak Woods	NA-3 (RSH)	T5N, R2E, Sections 25, 26, City of Franklin	Milwaukee County and private	22	This is a small dry-mesic oak woods of moderate quality, with a large population of black haw (<i>Viburnum prunifolium</i>), a State-designated special concern species
18	Root River Parkway Prairie	NA-3	T5N, R21E, Section 27, City of Franklin	Milwaukee County	27	Wet-mesic prairie located within the Root River Parkway wetland complex. Characteristic species include big bluestem, saw-toothed sunflower, Virginia mountain mint, prairie cordgrass, leadplant, azure aster, bottle gentian, prairie dock, and slender ladies'-tresses orchid. It is the largest prairie remaining in Milwaukee County.
19	Ryan Creek Woods	NA-3	T5N, R21E, Section 28, City of Franklin	Private	87	One of the larger woodlots remaining in Milwaukee County, this is a dry-mesic woods of varying quality that is recovering from past disturbance. An east-west stream crosses the south end.
20	Franklin Oak Woods and Oak Savanna	NA-3	T5N, R21E, Section 29, City of Franklin	Milwaukee County	76	The entire site is a former oak savanna, but only the north portion retains this appearance. Here are large, scattered, open-grown bur oaks, but the understory consists mainly of weeds, with a few prairie species persisting. The south portion has degraded further into a dense shrubland. This site, especially the north portion, would be a prime candidate for savanna restoration.
21	Elm Road Woods	NA-3 (RSH)	T5N, R21E Section 36, City of Franklin	Private	20	A small, mostly second-growth woodlot of southern mesic forest and lowland hardwoods. American beech is present at the western edge of its range. Contains good population of two State-designated special concern species: American gromwell (<i>Lithospermum latifolium</i>) and black haw (<i>Viburnum prunifolium</i>).
22	Grant Park Woods—South	NA-3	T5N, R22E, sections 1, 12, City of South Milwaukee	Milwaukee County	45	A remnant of the once more-widespread beech-maple mesic woods along Lake Michigan, this is a narrow wooded strip of moderate quality in Grant Park. Bordered on the west by golf course.
23	Grant Park Woods—Old Growth	NA-3 (RSH)	T5N, R22E, Section 1, City of South Milwaukee	Milwaukee County	38	Dissected by ravines, this site has long been used as a park. Despite the heavy human influence, this beech-maple woods, which is a remnant of the original Lake Michigan forest, retains some of its pre-settlement character. The rich ground flora includes the State-designated endangered blue-stemmed goldenrod (<i>Solidago caesia</i>).
24	Esch-Honadel Woods	NA-3 (RSH)	T5N, R22E, Section 18, City of Oak Creek	Private	72	A patchy mix of low woods, second-growth upland forest, and relatively undisturbed beech woods. Integrity of the woods is threatened by encroaching residential development.

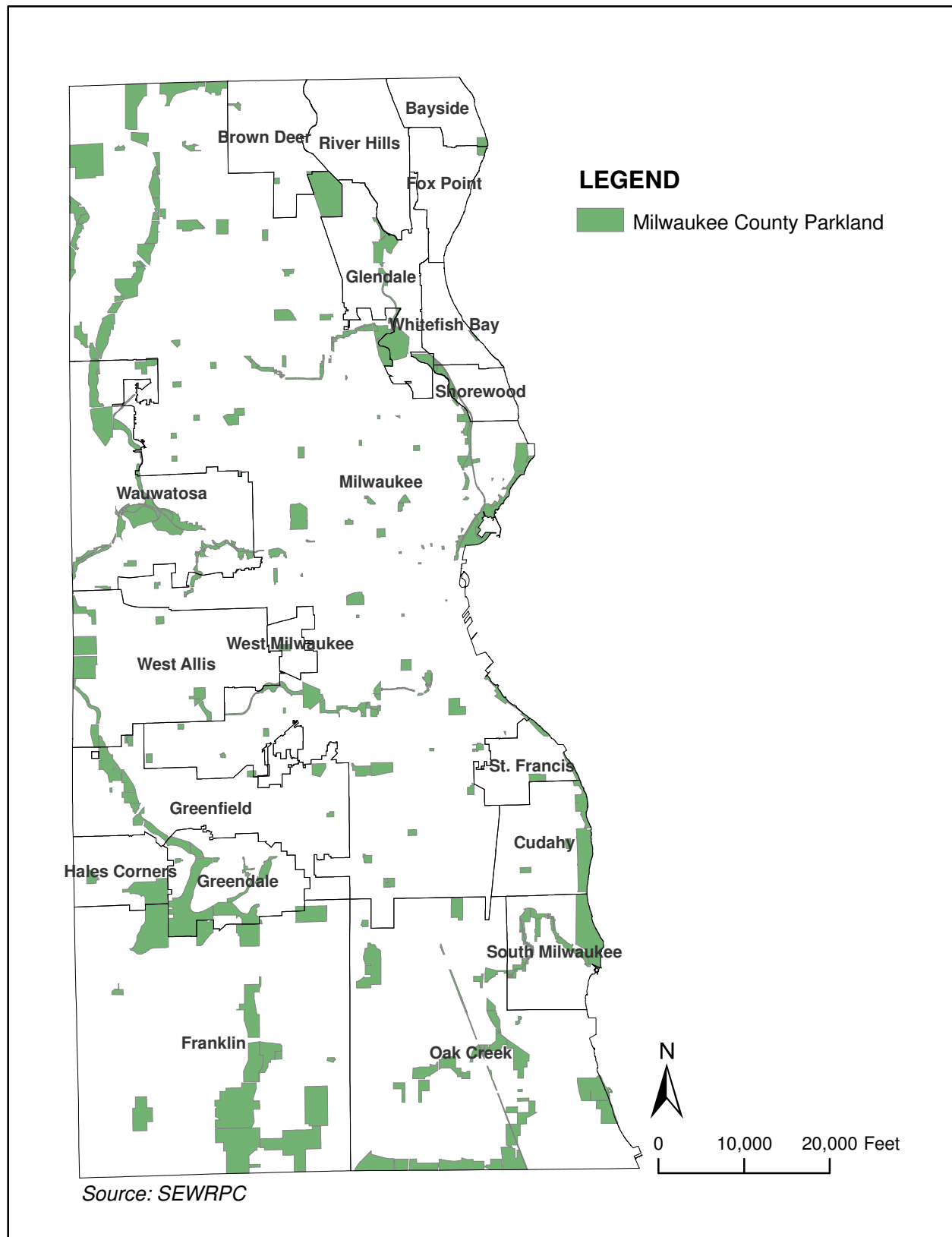
25	Wood Creek Woods	NA-3 (RSH)	T5N, R22E, Section 20, City of Oak Creek	Private	35	This is a patchy mixture of mature mesic and dry-mesic upland woods, regenerating forest, wet-mesic forest, stream, and ephemeral ponds. Quality varies throughout. The site is threatened by future residential development.
26	Wedge Woods	NA-3 (RSH)	T5N, R22E, Section 23, City of Oak Creek	Private	19	A small, disturbed woods consisting of lowland hardwoods at the low, wet west end, and dry-mesic woods at the drier east end. Contains one of the largest populations of the State-designated endangered blue-stemmed goldenrod (<i>Solidago caesia</i>) in the State. Threatened by residential development.
27	Oak Creek Low Woods	NA-3 (RSH)	T5N, R22E, Sections 26, 27, City of Oak Creek	Milwaukee County and private	68	Moderate-quality wet-mesic woods, with small areas of mesic woods.
28	Root River Riverine Forest	NA-3 (RSH)	T5N, R22E, Sections 31, 32, 33, 34, City of Oak Creek; T4N, R22E, Sections 3, 4, 5, 6, Town of Caledonia	Milwaukee County, Racine County, Wisconsin Department of Transportation, and private	140 (plus 184 in Racine County)	A significant portion of the Root River corridor. Extends south into Racine County.
29	Whitnall Park Woods—North	NA-3 (RSH)	T6N, R21E, Section 32, Village of Hales Corner	Milwaukee County	82	Stands of dry-mesic and lowland hardwoods within Whitnall Park. Contains forked aster (<i>Aster furcatus</i>), a State-designated threatened species.
30	Menomonee River Swamp—South	NA-3 (RSH)	T7N, R21E, Section 6, City of Wauwatosa	Milwaukee County, City of Milwaukee, and Wisconsin department of Transportation	39	A portion of the Menomonee River bordered by lowland hardwood forest and dry-mesic upland woods. Contains American gromwell (<i>Lithospermum latifolium</i>), a State-designated special concern species.
31	Harley-Davidson Woods	NA-3 (RSH)	T7N, R21E, Section 6, City of Wauwatosa	Harley-Davidson, Inc.	11	A small southern mesic hardwoods dominated by sugar maple and basswood, with a rich ground flora.
32	Currie Park Low Woods	NA-3 (RSH)	T7N, R21E, Section 8, City of Wauwatosa	Milwaukee County	27	A portion of the Menomonee River bordered by disturbed lowland hardwoods and wet-mesic hardwoods. The ground flora is rich, including such rare species as the State-designated threatened forked aster (<i>Aster furcatus</i>).
33	Blue Mound County Club Woods	NA-3 (RSH)	T7N, R21E, Section 17, City of Wauwatosa	Milwaukee County	16	A small patch of southern dry-mesic woods containing critical species habitat.
34	Wil-O-Way Woods	NA-3	T7N, R21E, Section 20, City of Wauwatosa	Milwaukee County	41	Moderate-quality southern dry-mesic hardwoods containing a representative ground flora.
35	Jacobus Park Woods	NA-3 (RSH)	T7N, R21E, Section 27, City of Wauwatosa	Milwaukee County	11	A small remnant of the original southern dry-mesic forest on bluffs overlooking the Menomonee River. Contains several populations of the State-designated threatened forked aster (<i>Aster furcatus</i>), as well as other regionally rare species.
36	Downer Woods	NA-3	T7N, R22E, Section 10 City of Milwaukee	University of Wisconsin-Milwaukee	13	A disturbed southern dry-mesic hardwood forest where scattered large oaks and smaller ashes and basswoods dominate the tree stratum. There is a thick shrub layer of natives and exotics. One of the few undeveloped woods within this part of the County.
37	Bradley Woods	NA-3 (RSH)	T8N, R21E, Section 9, City of Milwaukee	Milwaukee County and private	35	An old-growth southern mesic forested island, dominated by sugar maple, beech, and basswood. One of the few remnants of the original forest remaining in northern Milwaukee County. The western portion, owned by the County, is least disturbed.

38	Brown Deer Park Woods	NA-3	T8N, R21E, Section 13, Village of Brown Deer	Milwaukee County	40	Small islands of remnant southern mesic hardwoods within a golf course matrix, dominated by beech and sugar maple.
39	Harbinger Woods	NA-3 (RSH)	T8N, R21E, Section 18, City of Milwaukee; T8N, R20E, Section 13, Village of Menomonee Falls	Milwaukee County and private	34 (plus 13 in Waukesha County)	Mesic upland woods and lowland hardwoods bordering the Menomonee River that extend into Waukesha County. The spring flora of the mesic woods is rich and diverse including American gromwell (<i>Lithospermum latifolium</i>), a State-designated special concern species.
40	Menomonee River Swamp—North	NA-3	T8N, R21E, Sections 19, 30, City of Milwaukee; T8N, R20E, Section 24, Village of Menomonee Falls	Milwaukee County and private	74 (plus 4 in Waukesha County)	Discontinuous patches of disturbed floodplain forest bordering the Menomonee River.
41	Haskell Noyes Park Woods	NA-3	T8N, R21E, Section 21, City of Milwaukee	Milwaukee County	20	Disturbed southern mesic hardwood forested island with a substantial amount of beech. Best old-growth remnant is near center of woods. Pond and wetlands are present at south end.
42	Schlitz Audubon Center Woods and Beach	NA-3 (RSH)	T8N, R22E, Sections 9, 10, Village of Bayside	Schlitz Audubon Center and Milwaukee County	54	Site includes lake Michigan sand beach and disturbed mesic woods bordering a steep ravine. On the beach was found sea rocket (<i>Cakile edentula</i>), a State-designated special concern species.
43	Kletzsch Park Woods	NA-3 (RSH)	T8N, R22E, Section 19, City of Glendale	Milwaukee County	13	A disturbed remnant of southern mesic to dry-mesic forest on the west bank of the Milwaukee River. The diversity of habitats (upland woods, ravine, floodplain, and slope) has resulted in a diverse ground flora, including the State-designated threatened forked aster (<i>Aster furcatus</i>).

Milwaukee County already owns parkland with undeveloped or lightly developed land along lakes, rivers and streams. There is strong interest among citizens to protect the land along these waterways. Shorelands are becoming increasingly sought after and expensive. Milwaukee County has taken the initiative to purchase such lands to maintain important primary corridors, to prevent fragmentation of valuable wildlife habitat, protect groundwater recharge areas, and to provide undeveloped buffers to protect water quality. The current extent of Milwaukee County Parklands is shown in Figure 13.

Acquiring agricultural land surrounding nearby parks or stream corridors has helped Milwaukee County to be at the forefront in developing an effective park and parkway system. Such an initiative directly helps to preserve farmland, provide landscapes in which to restore prairies and wetlands, provide buffers against encroaching development, prevent fragmentation of valuable wildlife habitat, and help to preserve our agricultural heritage.

FIGURE 13. MILWAUKEE COUNTY PARKLAND



2.4 WATER RESOURCES

Groundwater Resources

Groundwater resources constitute an extremely valuable element of the natural resource base of Milwaukee County. The groundwater reservoir not only sustains lake levels and provides the base flow of the streams in the county, but comprises a source of water supply for domestic, municipal, and industrial water users in some parts of Milwaukee County. Like surface water, groundwater is susceptible to depletion in quantity and to deterioration in quality. An important consideration in land use and public facility development, therefore, is the protection of the quantity and quality of this valuable resource.

Groundwater is contained in one of four aquifers underlying the watershed – sand and gravel, eastern dolomite (limestone), sandstone and dolomite, and crystalline bedrock. An aquifer is an underground rock or soil formation that stores and transmits water to lakes, streams, and wells. Aquifers in the Milwaukee County area are discussed in order of occurrence beneath the surface.

The sand and gravel aquifer is comprised of surface material deposited from glacial ice that covered the region approximately 11,000 years ago. These deposits, which can occur up to 200 feet deep, are unconsolidated soil materials with physical and chemical characteristics different from agricultural soils.

Groundwater in these deposits occurs and moves in the void spaces among the grains of sand and gravel. It is locally important as a source of groundwater for both public and private use where there are relatively thick saturated unconsolidated deposits. The potential for contamination is high because of the shallow depth to groundwater and permeability of the material.

The eastern dolomite aquifer occurs beneath the sand and gravel formation. It was deposited approximately 400 million years ago and is 300 to 400 feet thick. It consists of both the Niagara dolomite formation and an underlying shale layer (Maquoketa shale). Dolomite is a brittle rock similar to limestone that contains ground water in interconnected cracks. The Maquoketa shale formed from impermeable clays and prevents water from moving between the Niagara dolomite and the deeper aquifers. Most potable water used in the county for domestic use comes from this formation.

The sandstone and dolomite aquifer occurs beneath the eastern dolomite formation in deposits between 425 and 600 million years old. In eastern Wisconsin, most users of substantial quantities of water (such as industrial users) tap this deep aquifer to ensure adequate supplies are available.

The crystalline bedrock aquifer is located beneath the sandstone and dolomite aquifer in formations more than 600 million years old. The aquifer is not a primary source of water in Milwaukee County. Most of the deposits are very dense crystalline rock, which normally yield

small amounts of water. Fractures in the crystalline structured rocks store water, but the quality and reliability of this water source and the extreme depth restrict its use.

Surface Water Resources

Lakes, streams, and associated flood-lands constitute an extremely valuable part of the natural resource base of Milwaukee County. They constitute a focal point of water-related recreational activities; provide an attractive setting for properly planned residential development; and have immeasurable environmental value.

Lakes and streams are extremely susceptible to deterioration through improper land management in both rural and urban areas. Water quality can degenerate as a result of excessive nutrient loads from malfunctioning or improperly placed septic systems, over-application of lawn care products, inadequate operation of waste treatment facilities, careless agricultural practices, inadequate stormwater management, etc.

Section 303(d) of the federal Clean Water Act requires Wisconsin to periodically submit a list of waters to the Environmental Protection Agency (EPA) that do not meet the state's water quality standards. The most recent list of impaired waters was submitted to the EPA by the Wisconsin Department of Natural Resources in April 2004. Table 3 is a list of impaired waters within Milwaukee County, as submitted to the EPA in 2004.

TABLE 3. 303(D) LIST OF IMPAIRED WATERS IN MILWAUKEE COUNTY (2004)

Water	Watershed	Impairment
Tietjen Beach / Doctor's Park	Lake Michigan	Bacteria
McKinley Beach	Lake Michigan	Bacteria
Bradford Beach	Lake Michigan	Bacteria
South Shore Beach	Lake Michigan	Bacteria
Beaver Creek	Milwaukee River South	Aquatic toxicity
Indian Creek	Milwaukee River South	Aquatic toxicity, degraded habitat, dissolved oxygen, temperature
Jackson Park Pond	Milwaukee River South	Fish consumption advisory
Lincoln Creek	Milwaukee River South	Aquatic toxicity, degraded habitat, dissolved oxygen, temperature
Little Menomonee River	Milwaukee River South	Aquatic toxicity
Milwaukee River Estuary	Milwaukee River South Menomonee Kinnickinnic	Aquatic toxicity, bacteria, dissolved oxygen, fish consumption advisory
Milwaukee River	Milwaukee River South	Fish consumption advisory
Natural channel reaches (T8N R21E SW NW 12)	Milwaukee River South	Degraded habitat
Oak Creek	Oak Creek	Aquatic toxicity

Milwaukee County has 68 lakes, ponds or lagoons mostly within the county's parks system. These ponds and lagoons are listed in Table 4 (see below).

TABLE 4: LAKES, PONDS AND LAGOONS IN MILWAUKEE COUNTY

Water Body	Municipality	Surf Area (Acres)	Shoreline (mi)	Max Depth (ft)
Aviary Ponds	Wauwatosa	0.4	0.1	
Bender Park (2 dry basins)	Oak Creek	0.1	0.0	0
Brown Deer Golf Lagoon Hole #1	Brown Deer	0.7	0.2	
Brown Deer Golf Lagoon Hole #16	Brown Deer	0.2	0.1	
Brown Deer Golf Lagoon Hole #18	Brown Deer	0.3	0.1	
Brown Deer Park Lagoon	Brown Deer	6.4	0.8	6
County Grounds MMSD Ponds-Proposed	Wauwatosa	0.2	0.1	
County Grounds Pond #1 (3 basins in a series)	Wauwatosa	2.1	0.3	8
County Grounds Pond #10	Wauwatosa	1.3	0.4	
County Grounds Pond #2 (3 basins in a series)	Wauwatosa	1.1	0.2	8
County Grounds Pond #3 (3 basins in a series)	Wauwatosa	0.6	0.1	8
County Grounds Pond 87th & Watertown Plank Road	Wauwatosa	1.8	0.3	
County Zoo - Monkey Island	Wauwatosa	0.4	0.2	
Dineen Park Lagoon	Milwaukee	2.0	0.2	6
Dretzka Park Golf Course Pond - C	Milwaukee	2.6	0.3	8
Dretzka Park Golf Course Pond - N	Milwaukee	0.8	0.2	4
Dretzka Park Golf Course Pond - S	Milwaukee	1.1	0.3	4
Estabrook Park Lagoon	Shorewood	1.1	0.2	4
GMIA Parking Structure	Milwaukee	2.3	0.2	0-0.2
Grant Park Golf Course	South Milwaukee	0.1	0.1	4
Grant Park Lagoon (Central)	South Milwaukee	0.6	0.1	
Grant Park Lagoon (North)	South Milwaukee	0.4	0.1	6
Greenfield Golf Course - east side of course	West Allis	0.4	0.1	3
Greenfield Park Lagoon	West Allis	6.5	1.0	6
Greenfield Park Lagoon - east of baseball diamond (N)	West Allis	0.6	0.1	6
Greenfield Park Lagoon - east of baseball diamond (S)	West Allis	0.2	0.1	
Greenfield Park Lagoon (by entrance)	West Allis	0.8	0.2	
Grobschmidt Park Pond - Mud Lake	Franklin	19.1	0.9	17
Hansen Golf	Wauwatosa	0.3	0.1	
Holler Park Lagoon	Milwaukee	0.3	0.1	5
Humboldt Park Lagoon	Milwaukee	4.0	0.5	5
Humboldt Park Lily Pond	Milwaukee	0.4	0.1	
Jackson Park Lagoon	Milwaukee	8.7	0.7	5
Jacobus Park Lagoon	Wauwatosa	0.5	0.2	4

TABLE 4: LAKES, PONDS AND LAGOONS IN MILWAUKEE COUNTY (con't)

Water Body	Municipality	Surf Area (Acres)	Shoreline (mi)	Max Depth (ft)
Kosciuszko Park Lagoon	Milwaukee	2.3	0.2	5
Lake Evinrude	Wauwatosa	4.7	0.5	5
Lincoln Park (Milwaukee River)	Milwaukee	21.4	1.2	
Little Menomonee River Pkwy. (North Lake)	Milwaukee	4.2	0.8	
McCarty Park Lagoon	West Allis	4.4	0.4	4
McGovern Park Lagoon	Milwaukee	5.0	0.9	4
Menomonee River Parkway Pond.	Wauwatosa	2.0	0.4	4
Mitchell Park Lagoon	Milwaukee	2.9	0.3	6
Moose Yard	Wauwatosa	0.4	0.1	
Noyes Park Pond	Milwaukee	0.5	0.2	1
Oak Creek Parkway Pond	South Milwaukee	4.8	0.7	
Oak Creek Parkway Pond	Oak Creek	3.0	0.4	10
Oakwood Golf (Central)	Franklin	1.5	0.2	
Oakwood Golf (North)	Franklin	1.8	0.2	
Oakwood Golf (South)	Franklin	1.3	0.2	
Research Park - Pond 5 (S.E. of Research Park)	Wauwatosa	2.1	0.4	
Root River Parkway Pond	Greendale	1.2	0.2	17
Root River Parkway Pond	Greenfield	6.4	0.9	
Root River Parkway Pond - Anderson Lake	Franklin	7.6	0.7	
Saveland Park Lagoon	Milwaukee	0.3	0.1	6
Scout Lake Park	Greendale	7.8	0.4	15
Sheridan Park Lagoon	Cudahy	1.5	0.2	4
Timmerman Airfield Basin	Milwaukee	6.0	0.4	
Uihlein Soccer Park	Milwaukee	0.9	0.2	
Underwood Creek Detention Pond	Wauwatosa	1.8	0.2	
Veterans Park Lagoon	Milwaukee	15.0	1.2	4
Warnimont Golf	Cudahy	0.8	0.1	
Washington Park Lagoon	Milwaukee	11.6	0.1	6
Wehr Nature Center - Whitnall Park	Franklin	16.6	1.5	
Whitnall Park Arboretum Pond	Franklin	2.6	0.4	
Whitnall Park Arboretum Pond - North of Drive	Hales Corners	0.8	0.2	4
Whitnall Park Arboretum Pond - South of Drive	Hales Corners	1.9	0.3	5
Whitnall Park Golf Course Pond - #13 Fairway	Franklin	0.3	0.1	
Wilson Park Lagoon	Milwaukee	8.6	0.8	5
Wisconsin Ave Park - Pond 7 - N.E. of Ball Diamond	Wauwatosa	1.1	0.2	

The major streams of Milwaukee County are listed in Table 5. Major streams are defined as perennial streams that maintain a continuous flow throughout the year except under extreme

drought conditions. Equally important are the unnamed intermittent streams that feed Milwaukee County's major streams. For Wisconsin Pollutant Discharge Elimination System (WPDES) permitting purposes, several of the major streams are designated by the state as Priority Navigable Waterways (PNW) or Areas of Special Natural Resource Interest (ASNRI). No water bodies designated as an Outstanding or Exceptional Resource occur within the County.

TABLE 5: MAJOR STREAMS OF MILWAUKEE COUNTY

Watershed	Major Stream	Approximate Length (Miles)	State Water Body Designation (For WPDES permitting purposes)
Milwaukee River (South)	Milwaukee River	43.5	PNW, ASNRI (NHI, LLW)
	Lincoln Creek	9.2	PNW, ASNRI (NHI)
	Indian Creek	2.6	Not designated
Menomonee River	Menomonee River	32	PNW, ASNRI (NHI, LLW)
	Little Menomonee River	12	PNW, ASNRI (NHI, LLW)
	Lilly Creek	3.3	Not designated
	Underwood Creek	8.0	Not designated
	Honey Creek	9.0	PNW, ASNRI (NHI)
Kinnickinnic	Kinnickinnic River	6.0	Not designated
	Lyons Park Creek	0.8	Not designated
	Cherokee Park Creek	1.2	Not designated
	Wilson Park Creek	5.3	Not designated
	Villa Mann Creek	1.2	Not designated
	Holmes Avenue Creek	1.2	Not designated
	West 43 rd Street Ditch	5.5	Not designated
Oak Creek	Oak Creek	12.6	PNW, ASNRI (NHI)
	North Branch of Oak Creek	5.5	Not designated
Root River	Root River	28	PNW, ASNRI (NHI, LLW)

PNW = Priority Navigable Waterway

ASNRI = Areas of Special Natural Resource Interest

NHI = Natural Heritage Inventory Water

LLW = Land Legacy Water

The major streams of Milwaukee County occur within five watersheds, the Milwaukee River South, the Menomonee River, the Kinnickinnic River, the Root River, and Oak Creek (Figure 4). The characteristics of each watershed are discussed briefly below. The Lake Michigan Shoreline is considered a sixth watershed for purposes of this plan.

A small portion of the Fox River Watershed occurs in the southeastern corner of the County. Within Milwaukee County, the boundary between the Fox River Watershed and the Root River Watershed is a sub-continental divide, in which runoff water located east of the boundary ultimately flows into Lake Michigan, and runoff water located west of the boundary ultimately

flows south into the Mississippi River. As the Fox River Watershed consumes less than one percent of the total land area in Milwaukee County, it will not be discussed in this plan.

Three of the watersheds, Milwaukee River South, the Menomonee River and the Kinnickinnic River are part of the Milwaukee River basin. Of these, only the Kinnickinnic River watershed is fully located within Milwaukee County.

Complete discussions of water quality information for each of the watersheds is available within each respective, comprehensive water quality plan and/or basin report, as well as in the Milwaukee County Stream Assessment (see List of References). Information from the basin reports, as well as land use data provided by the Southeastern Wisconsin Regional Planning Commission, is summarized below.

Milwaukee River South Watershed

General Watershed Characteristics

The Milwaukee River South Watershed is a 168 square-mile elongated drainage area located in Ozaukee and Milwaukee counties. It contains 108 miles of perennial streams, 3 named lakes, many park ponds, and several unnamed lakes greater than 10 acres. It is a subwatershed of the Milwaukee River Basin.

Land use consists of a mix of urban and rural uses. Urban land use represents 33% of the land use within the watershed; agriculture (25%), grasslands (21%), forests (12%), and wetlands (6%) make up the remaining land uses.

In 2001, the State of the Milwaukee River Basin (WDNR) was released. This document provides an overview of land and water quality within the basin and describes challenges facing the basin.

Land & Water Resource Assessment

Major threats to water quality within the watershed include stream and wetland modification, urban and agricultural runoff, municipal and industrial point sources, construction site erosion, stream bank erosion, and contaminated sediments.

Pollution and stream and wetland modification have degraded surface waters and reduced opportunities for aesthetic, recreational, and biological uses of the river system. For example, nearly 15% of all perennial streams within the watershed have been modified to the extent that they have limited ability to sustain diverse biological communities. In addition, the majority of the tributaries within the watershed are capable of supporting only those species (such as carp) tolerant to pollution.

The Milwaukee River South watershed was designated as a “priority watershed” in 1984 under the Wisconsin Non-point Source Water Pollution Abatement Program. The Milwaukee River Estuary, which encompasses the Milwaukee Harbor, the Milwaukee River downstream of the abandoned North Avenue Dam, the Menomonee River downstream of 25th street, and the Kinnickinnic River downstream of Chase Avenue, was designated as a Great Lakes Area of

Concern in 1987 by the International Joint Commission and the Environmental Protection Agency (EPA).

Menomonee River Watershed

General Watershed Characteristics

The Menomonee River Watershed is a 136 square-mile elongated drainage area located in Ozaukee, Milwaukee, Washington and Waukesha counties. This watershed includes 96 miles of streams and several ponds, and is a subwatershed of the Milwaukee River Basin.

About 42% of the lands within the Menomonee River Watershed are in urban use. The remaining land uses are composed of grasslands (22%), agriculture (17%), forests (8%), and wetlands (7%). Most of the urban land use is located in Milwaukee County.

In 2001, the State of the Milwaukee River Basin (WDNR) was released. This document provides an overview of land and water quality within the Menomonee River Watershed and details challenges facing it.

Land & Water Resource Assessment

The major contributors to degraded water and habitat quality in the watershed are stream and wetland modification, urban and rural runoff, construction site erosion, contaminated sediments, and industrial point sources.

Channelization and impoundment of natural streams in this watershed is prevalent. However, the removal of the Falk Corporation Dam and concrete drop structure in 2000 has allowed seasonal runs of Lake Michigan trout and salmon up to the Lepper Dam in Menomonee Falls.

The Menomonee River Watershed was designated a “priority watershed” in 1984 under the Wisconsin Nonpoint Source Water Pollution Abatement Program. In addition, over five miles of the little Menomonee River have been designated as the Moss American Superfund Site due to creosote-contaminated sediments. Work is currently being performed to clean up the site.

Kinnickinnic River Watershed

General Watershed Characteristics

The Kinnickinnic River watershed is a 33 square-mile drainage area located entirely within Milwaukee County. It contains 25 miles of perennial streams and seven park ponds. It is the most urban of the watersheds found within Milwaukee County, and is a subwatershed of the Milwaukee River Basin.

Land use within the watershed area is largely urban (78%); grasslands (16%) and forests (4%) within open spaces comprise the remaining land use. The urban portion of the watershed is mostly developed with residential areas and small to medium sized industrial parks. A portion of General Mitchell International Airport is located within the watershed.

The State of the Milwaukee River Basin (WDNR 2001) provides an overview of land and water quality within the watershed. It also details challenges facing the watershed.

Land & Water Resource Assessment

The major contributors to degraded water and habitat quality in the watershed are stream and wetland modification, urban runoff, construction site erosion, contaminated sediments, and industrial point sources.

The General Mitchell International Airport (GMIA) has historically discharged airplane deicing fluid (glycol), associated metals, and other contaminants through snowmelt and rainwater to Wilson Park Creek, a tributary to the Kinnickinnic River. The GMIA has recently implemented management measures to reduce the amount of glycol reaching the tributary.

The Kinnickinnic River Watershed was designated a “priority watershed” in 1990 under the Wisconsin Nonpoint Source Water Pollution Abatement Program.

Oak Creek Watershed

General Watershed Characteristics

The Oak Creek watershed is a natural surface-water drainage basin of approximately 26 square miles. It contains 21.2 miles of perennial streams and one named lake. Oak Creek and its tributaries, the North Branch of Oak Creek and the Mitchell Field Drainage Ditch, discharge to Lake Michigan at Grant Park in the City of South Milwaukee. The Oak Creek Watershed is a subwatershed of the Root-Pike River Basin.

Land use within the watershed area is largely split between urban (39%) and grasslands (33%). Forests (14%), agriculture (11%), and wetlands (3%) make up the remaining land uses. The watershed lies in a rapidly urbanizing portion of Milwaukee County; as such, urban runoff contributes the majority of drainage entering Oak Creek and its tributaries.

The State of the Root-Pike River Basin (WDNR 2002) provides an overview of land and water quality within the Oak Creek watershed. It also details challenges facing the watershed.

Land & Water Resource Assessment

The major contributors to degraded water and habitat quality in the watershed are channelization, contaminated sediments, hydrological modification, urban runoff, and stream bank erosion.

Approximately 61% of the total combined length of streams or tributaries in the watershed are listed on the State’s impaired waterbody 303(d) list. Fish species found in the streams reflect the range of water quality found in the watershed.

Root River Watershed

General Watershed Characteristics

The Root River watershed, with approximately 117 miles of perennial streams and 12 named ponds and lakes, drains approximately two-thirds of the Root-Pike River Basin (totaling approximately 198 square miles).

The watershed headwaters are located in the southwestern portion of Milwaukee County including the municipalities of Franklin, Greendale, Greenfield, Hales Corners, Milwaukee, West Allis and Oak Creek.

Land use with the watershed is largely agricultural (54%). Grasslands (18%), urban areas (16%), barren and shrubland areas (6%), and wetlands (6%) make up the remaining land uses. The southwestern corner of Milwaukee County is occupied by the singular expanse of rich agricultural land remaining in the county.

The State of the Root-Pike River Basin (WDNR 2002) provides an overview of land and water quality within the watershed. It also details challenges facing the watershed

Land & Water Resource Assessment

The major contributors to degraded water and habitat quality in the watershed are stream and wetland modification, hydrological modification, urban runoff, stream bank erosion, and industrial point sources.

Water quality of the rivers and streams in the Root River ranges from severely degraded to good. Fifty percent of the perennial streams currently support a Warm Water Sport Fish community, 15% support Warm Water Forage Fish community, and 15% support a Limited Forage Fish community. Fish species found in the streams reflect the range of water quality found in the watershed.

Lake Michigan Shoreline

General Characteristics

In addition to the watersheds that drain into Lake Michigan, there are many small catchment areas along the Lake Michigan Shoreline that drain into the lake. The Lake Michigan shoreline occupies about thirty miles of the eastern boundary of Milwaukee County. The shoreline and associated drainageways are therefore considered another watershed (reference *A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin*, SEWRPC 1997).

Land & Water Resource Assessment

Lake Michigan Bluff Erosion

Shoreline erosion and bluff stability conditions are important considerations in planning for the protection and sound development and re-development of lands located along the Lake Michigan shoreline. Erosion of the Lake Michigan shoreline is an essentially natural process. However, human activities can influence this process, causing erosion to accelerate or

decelerate. Various factors contribute to bluff and beach erosion. Broad, indirect factors such as climate and lake levels, as well as the direct factors, such as wave action, groundwater seepage, storm-water runoff rates and volumes of flow, freeze-thaw action, lake ice movement, the type of bluff and beach material, and the type of vegetative cover.

Some Lake Michigan bluffs do incorporate bedrock formations within their structure, making them extremely resistant to the erosive forces of wind, waves and runoff. However, the Lake Michigan bluffs of the County are composed of unconsolidated sediments, primarily sands, silts, and clays that tend to slough off in shallow layers and in deep slips. Bluff erosion occurs in the form of toe erosion, slumping, sliding, flow, surface erosion, and solifluction, resulting in the intermittent recession of the bluff.

Two forms of slides are common along the Milwaukee shoreline: translational slides, and rotational slides or slumps. Translational slides involve a surface layer several inches to a few feet thick, sliding parallel to the face of the slope. Rotational slides often involve the slumping, or sliding, of a large mass along a curved surface. Slumps usually take place suddenly and can cause extensive damage since they can result in a large recession of the bluff.

Flows occur when large amounts of water are present and the soil mass actually moves like a viscous fluid. Solifluction, related to flow, is caused by freeze-thaw activity. Sheet wash, rill, and gully erosion result from surface water runoff flowing over the top of the bluff and over the slope face itself.

Beach Erosion and Shoreline Recession

Beaches in Southeast Wisconsin are composed primarily of mixtures of sand and gravel. Beach materials, and hence the appearance of the beach, are in a constant state of flux. Storm events, which produce high, steep waves along the Southeastern Wisconsin (Milwaukee County) coast, tend to be erosive in nature, while the small waves occurring between storms tend to build beaches. Shoreland loss is the result of beach and bluff erosion processes. Wave and wind action gradually removes shoreline materials into the Lake, where they are transported offshore or along shore by lake currents.

Milwaukee County has had an ongoing program of stabilizing bluffs and shorelines on county-owned property. To protect the Lake Michigan shoreline, an erosion management plan was developed for Milwaukee County. Many of the recommended improvement measures have been or are intended for implementation (see Appendix 1 for a description of projects).

Beach Closings

Beach closings, resulting from elevated levels of *E. coli* bacteria, have increased over the past several years. A Southeast Wisconsin Beach Task Force was formed to identify the sources of bacterial pollutants that are responsible for beach closings, and to develop and encourage measures to reduce or eliminate such pollutants. Their preliminary report, issued in 2002, reports early findings from research being conducted on the subject and provides recommendations for actions to address the problem. Such actions include moving or eliminating waterfowl in beach areas, reducing direct stormwater flows into the lake, and

improving water circulation in beach areas. The Aquatics Director for Milwaukee County currently serves on the Southeast Wisconsin Beach Task Force.

To date, Milwaukee County has undertaken several steps to help eliminate beach closings. Bradford Beach has been graded and groomed in an attempt to reduce bacterial concentrations in the sand. Milwaukee County is also evaluating what to do with storm sewer outfalls that discharge stormwater across the beach. At South Shore Park, a stormwater treatment device was installed to treat polluted runoff from paved areas before entering the lake. Milwaukee County will continue to work with the Beach Task Force to keep the beaches clean and open.

Point Source and Nonpoint Source Pollution Control Initiatives

Point Source Pollution

Discharges and/or surface water runoff from industrial sources and sanitary sewers affect water quality. Point source discharges, including storm sewer discharges, are regulated by the Wisconsin Department of Natural Resources under the Wisconsin Pollutant Discharge Elimination System (WPDES) permit system. The WPDES permit system is authorized by Chapter 283 of the Wisconsin Statutes; Chapter 216 of the Wisconsin Administrative Code established criteria defining the stormwater discharges that require a WPDES stormwater permit. Revisions to Chapter 216, adopted in August 2004, require that Milwaukee County, as an urbanized area with a residential population of at least 50,000 and an overall population density of at least 500 people per square mile, obtain a stormwater discharge permit. The County has applied for a Countywide NR 216 permit, but has not received the permit as of the date of this report. General Mitchell International Airport, a County facility, has had a WPDES permit for stormwater discharges since 1996.

To help control and regulate point source discharges, inventories of point sources have been compiled. An example is the inventory of point sources compiled in the *Milwaukee River Integrated Basin Management Plan: 2000*, Vol. 4. Additionally, major cooperative efforts are also underway to reduce pollution from combined sewer overflows and discharges from sanitary relief devices in the Milwaukee Metropolitan Sewerage District (MMSD) area. An example of an effort that is currently underway is a survey of Milwaukee County's sanitary sewers to find and correct inflow and infiltration problems.

Nonpoint Source Pollution

Nonpoint source pollution currently presents the greatest threat to water quality in Wisconsin. Several initiatives addressing this problem are currently underway within the County.

“Urban and rural nonpoint pollution is the leading cause of water quality problems in Wisconsin....”

- Nonpoint Source Program Redesign Initiative Report, December 1999,
Wisconsin Department of Natural Resources

Stream Bank and Shoreline Erosion

Soil erosion can create serious surface water problems, since the resulting sediment is volumetrically the major pollutant entering surface waters. This is often due at least in part to the filling of peripheral wetlands, which removes valuable nutrient and sediment traps while adding nutrient and sediment sources. Stream bank erosion, if severe, contributes to the degradation of surface water quality and navigability of adjacent waterways. Unstable banks are typically devoid of healthy vegetative cover, and so do not provide good riparian habitat for diverse aquatic or terrestrial populations of plants and animals.

Milwaukee County recently completed an assessment of the stability and fluvial geomorphic character of 140 miles of stream channels within the four watersheds of Milwaukee County. Many of the 34 streams surveyed were characterized as degraded (of incising condition). Table 6 lists common factors associated with urbanization that contribute to degraded stream channels.

TABLE 6. FACTORS CONTRIBUTING TO STREAM DEGRADATION.

Factor	Result
Channel straightening	Increased erosive energy of a stream
Increased discharge rates from impervious surfaces, storm sewers and culverts	Increased stream velocity
Removal of riparian vegetation and in-stream woody debris	Decreased in-stream channel roughness
Altering of baseflow, as well as periods, levels, and timing of saturation	Changes in the geotechnical loading characteristics of the stream banks
Change in riparian vegetation (deforestation, turfgrass management)	Increased erosion through removal of soil-binding root systems

The stream assessment identified problem areas along specific reaches of streams and recommended restoration techniques (including dam manipulation, realignment, bank erosion, grade control, and floodplain or riparian restoration) for improving stream stability. Each restoration project was then ranked and prioritized based on the problem's threat to public safety and risk to infrastructure, and the project's recreational impact, ecological benefit, and complexity and cost. A copy of the report can be obtained from the Milwaukee County Department of Transportation and Public Works, Environmental Services/Land Conservation Department.

Also recently completed is the Milwaukee County Pond and Lagoon Management



Study, which evaluated the current environmental quality of the 68 ponds, lakes, and lagoons on County property. Most of the water bodies were found to be in a eutrophic state, and suffering from shoreline erosion and poor water quality. The Pond and Lagoon Management Plan (not yet approved by the Milwaukee County Board) recommended that three pilot projects be performed to identify the best approaches for improving water quality conditions within the water bodies. The pilot projects involve the use of innovative technologies and Best Management Practices, including biologs, buffer gardens, and pond draining. Implementing the recommendations from these two studies is an important component of the Land and Water Resource Management Plan.

Several other steps have been taken to reduce stream bank erosion within the County. Buffer strips have been installed along storm water ponds on the County Grounds and on the Wisconsin Avenue Lagoons. The County has performed several stream bank stabilizations projects; these projects, such as Grantosa Creek BMP, utilized bioengineering techniques as well as native plantings for shoreline stabilization (see Appendix 1 for project descriptions).

Development-Related Nonpoint Source Pollution

With respect to construction and development-related nonpoint source pollution, lakes and streams can be adversely affected by excessive development of lakeshore and riverine areas. Construction site erosion can lead to problems on the site itself, including rilled and gullied slopes and washed-out roads. It can also lead to off-site problems, including clogged culverts and road ditches.

Construction site erosion can be minimized through appropriate soil erosion control practices. Such practices include seeding, sodding, and mulching to stabilize disturbed ground; use of sedimentation basins and filter fences to minimize the amount of sediment leaving the site; and runoff diversion from upland areas.

State standards for non-agricultural facilities and practices that may cause nonpoint runoff pollution were set forth in 2002 (Table 7, as shown on page 42). Since Milwaukee County is entirely incorporated, each municipality within Milwaukee County is charged with implementing and enforcing the non-agricultural standards. To do this, municipalities have developed a Construction Site Erosion Control (CSEC) ordinance in accordance with state law. An example of a Construction Site Erosion Control ordinance (for the City of Franklin) is provided in Appendix 1. This ordinance details compliance, enforcement, and appeal procedures relating to the non-agricultural performance standards. The municipal ordinances are available from each municipality's office, and many are also available on the municipality's website (see Appendix 1 for a listing of these ordinances). In addition to local requirements, on a construction site of greater than one acre, an appropriate construction site erosion control plan must be submitted to the Wisconsin Department of Natural Resources or the Wisconsin Department of Commerce for review and approval.

TABLE 7. NON-AGRICULTURAL PERFORMANCE STANDARDS

Adopted Non-Agricultural Standards (NR 151.10-151.26)	
For new construction and redevelopment on sites of one acre or more:	
a)	Implement an erosion and sediment control plan using Best Management Practices (BMPs) to control sediment runoff.
For most sites covered by construction site erosion control plan:	
a)	Implement a written storm water management plan that conforms to WDNR and local government permit requirements.
For developed urban areas (population densities of 1000 or more people per square mile):	
a)	Implement a stormwater management plan that includes public education, leaf and grass management where appropriate, nutrient application on municipally-owned land according to an application schedule, and detection and elimination of illicit discharges.
b)	Permitted municipalities shall meet additional control requirements for reduction in total suspended solids.
For non-municipal property covering 5 or more acres of turf or other pervious surface:	
a)	Apply nutrients in accordance with a nutrient management schedule.
For transportation facilities:	
a)	Implement erosion and sediment control plans during construction and management plans for runoff after construction.

Note: Many activities referenced above are required and enforced by WDNR, US Army Corp of Engineers, and/or local units of government. Milwaukee County's role is anticipated to remain focused on technical support and on compliance with County-owned properties.

Ensuring that applicable operations and practices occurring on Milwaukee County-owned grounds are in compliance with the non-agricultural standards is a priority for Milwaukee County (such as at the Milwaukee County Zoo). Milwaukee County currently follows municipal ordinances relating to the non-agricultural standards, as applicable.

In order to ensure that all applicable operations within Milwaukee County are in compliance with state standards, the County collaborates with partners such as the University of Wisconsin Extension and Wisconsin Department of Natural Resources to host workshops and public seminars covering stormwater and construction site erosion issues. These workshops and seminars are designed to educate the development and construction community about the non-agricultural performance standards and Best Management Practices for ensuring compliance.

Agricultural-Related Nonpoint Source Pollution

State standards for agricultural nonpoint source pollution were approved in 2002 (Table 8, see page 45). These standards and prohibitions were developed for agricultural facilities, operations, and practices.

As of 2002, approximately 4.6% of Milwaukee County was used for farming, and only one dairy farm remained in the County. Because Milwaukee County is entirely incorporated and farming makes up a small percentage of the overall land use, this plan focuses more on compliance with the non-agricultural standards than with the agricultural standards. However, ensuring that applicable operations are in compliance with the agricultural standards is still a priority for Milwaukee County.

As Milwaukee County is entirely incorporated, each municipality is responsible for implementing the NR 151 agricultural standards and prohibitions. Milwaukee County currently follows municipal ordinances relating to the standards and prohibitions, when applicable. The standards and prohibitions also pertain to the Milwaukee County Zoo. In order to meet state standards, steps have been taken at the zoo to remove animal waste from stormwater (See Appendix 1 for project descriptions). Milwaukee County currently has no Farmland Preservation Agreements.

MILWAUKEE COUNTY PARKS AGRICULTURAL LANDS RESOURCE & LEASE VALUE ANALYSIS

In order to facilitate the reduction of nonpoint source pollution arising from agricultural lands owned by Milwaukee County, the County completed a study in 2004 that evaluated agricultural practices and the lease structure in the County's Agricultural Lease Program. The study identified current agricultural practices and problem areas, such as erodable lands or farmed wetlands. The study also identified non-compliance with contract requirements such as the maintenance of a 75-foot "no mow" buffer along waterways. Recommendations for program improvements that would reduce erosion and improve water quality included seeking cost-share opportunities for implementing buffer and filter strips, enrolling farmed wetlands in the Conservation Reserve Program (or a similar program), and requiring that hay, or a similar soil-stabilizing crop, be part of the crop rotation. Specific recommendations were also made for each agricultural field.



An example of a problem area: An eroded drainageway within a hay field.

Priority Farms

In order to ensure that all cropland and agricultural operations in Milwaukee County are in compliance with the NR 151 agricultural standards and prohibitions, cost-share and technical assistance may be provided to all eligible farms, with preference given to priority farms and operations. Priority Farms (or operations where multiple animal units are housed) are those that meet the following criteria:

- Farms/operations that are non-compliant with the state prohibitions and performance standards;
- Landowners who have received a "Notice of Discharge" (NOD);
- Agricultural lands identified as problem areas in the Milwaukee County Parks Agricultural Lands Resource & Lease Value Analysis;
- Agricultural lands or operations adjacent to impaired 303(d) list waters; and
- Agricultural lands or operations adjacent to Water Quality Management Areas.

Typically, determining priority for cost share and technical assistance is based on the criteria listed below:

1. Landowners receiving an NOD.
2. Landowners voluntarily requesting cost-share assistance for a parcel of land not meeting the NR 151 state standards and prohibitions.
3. Distance from a 303(d) listed water or ASNRI water.
4. Geographic location within Water Quality Management Areas.

Identification of priority farms/operations will occur by completing a transect survey and measuring T, which will be completed on 100% of the farms by the end of 2007. Noncompliant farms may also be identified through a review of existing records, interagency consultation, and annual monitoring. A checklist (provided in Appendix 2) may be used for farm or other applicable area reviews. A database may be created to track the status and monitoring of priority farms/operations. Owners of fields/operations that are not in compliance with the NR 151 standards will be notified following the annual monitoring.

Milwaukee County staff will work with UW Extension, NRCS, and FSA staff to educate owners about Best Management Practices (BMPs) and conservation initiatives (see Table 8, page 45) that can bring their fields/operations into compliance. This may be done through newsletters, brochures and other mailings, and during annual inspections. The actual mechanism for this educational outreach will be dependant on the actual circumstances. The Wisconsin Department of Natural Resources is responsible for enforcement of the standards and will also be responsible for preparing and issuing a Notice of NR 151 violation letter, status reviews, letters of notifications and other related reports.

Milwaukee County will also offer cost-share assistance to landowners for eligible conservation practices. Eligible conservation practices are identified in Chapter ATCP 50 Subchapter VIII. Examples include the installation of riparian buffers and decommissioning of a well.

TABLE 8. AGRICULTURAL PERFORMANCE STANDARDS AND PROHIBITIONS (NR 151.02–151.08).

Performance Standard	Effective Date	Conservation Initiatives
Control soil erosion on cropland to meet tolerable soil loss (T). (NR 151.02)	10/1/2002	Install buffer and filter strips, incorporate hay into crop rotations, utilize strip-cropping techniques, enroll farmed wetlands in CRP
Construct, maintain, and close manure storage facilities at all livestock operations and facilities to prevent manure overflows and leaks. (NR 151.05)	10/1/2002	Meet NRCS standards for construction, maintenance, and closure using technical standards: 313 (waste storage facility), 360 (closure of waste impoundments), 634 (manure transfer standard).
Divert clean water from feedlots at all livestock operations and facilities within Water Quality Management Areas. (NR 151.06)	10/1/2002	Install diversions, roof runoff systems, subsurface drains, and underground outlets.
On all croplands, control nutrient runoff into waters of the state. (NR 151.07)	10/1/2003 (new operations); 1/1/2005 (land near impaired or exceptional waters); 1/1/2008 (other existing farms)	Develop and follow annual nutrient management plans for applying fertilizer or manure. Base plans on soil tests conducted by DATCP certified laboratory. Use qualified planners. Apply nutrients according to UWEX recommendations for crops. Install additional conservation or management practices to reduce nutrient loading.
Manure management prohibitions applicable to all livestock producers: a. No overflow from manure storage facilities. b. No unconfined manure pile within a Water Quality Management Area. c. No direct runoff from feedlots or stored manure into the waters of the state. d. No unlimited access by livestock to waters of the state in a location where high concentrations of animals prevent maintenance of adequate vegetative cover. (NR 151.08)	10/1/2002	a. Design and construct facilities to technical standards; maintain facilities to technical standards, repair or replace facilities as needed. b. Relocate manure piles, construct manure storage facilities. c. Install runoff control systems, including diversions, roof runoff systems, subsurface drains, and underground outlets. Relocate or abandon animal feeding operations, install sediment and water control basins. Construct and maintain manure storage facilities to technical standards. d. Install access roads and livestock crossings, livestock fencing, and watering facilities. Stabilize critical areas and protect stream bank and shoreline areas.

2.5 INFORMATION MANAGEMENT AND DISTRIBUTION

Information sharing and educational outreach initiatives are critical to the County's long-term ability to protect natural resources. To be proactive in providing citizens, natural resource professionals, and the development community with the information needed for them to embrace environmental initiatives and make informed decisions, Milwaukee County developed a County-wide Geographic Information System (GIS) that contains all of the GIS data available within the County. Web mapping infrastructure was installed in order to make the County's GIS data available to the general public via the internet; the web system is planned to be functioning in 2006. A complete list of the GIS data (layers) within the County's system is provided in Appendix 1, examples of the data available in the system include location and descriptive data for wetlands, woodlands, transportation corridors, political boundaries, and infrastructure systems such as stormwater systems. This data is critical for planning for future development, protecting sensitive natural resources, and improving existing stormwater infrastructure.

Training opportunities that provide up-to-date information and technologies related to stormwater and natural resource issues and regulations are vital for meeting the goals in the Land and Water Resource Management Plan. Such opportunities promote cooperation and consistency in efforts among County personnel, natural resource professionals, and the development community. Milwaukee County employees have worked with partners such as the Federation of Environmental Technologists and the Wisconsin Department of Natural Resources to host in-house workshops and public seminars covering stormwater issues. The County also contributes funding to the University of Wisconsin Extension Service, which conducts outreach and training related to natural resource issues, as part of their Community Resource Development Program (see Table 9 below). Examples of projects by the University of Wisconsin Extension include an annual Construction Site Erosion Control Workshops that offer the latest information on erosion control techniques and regulations, and educational materials designed to teach citizens how to create rain gardens to treat storm water runoff on their properties.

TABLE 9. ANNUAL FUNDS CONTRIBUTED TO THE UNIVERSITY OF WISCONSIN EXTENSION SERVICE COMMUNITY RESOURCE DEVELOPMENT PROGRAM BY MILWAUKEE COUNTY.

Year	Amount
2002	\$333,829
2003	\$208,424
2004	\$192,054
2005	\$209,846
2006	\$209,260

Educational programs offered through nature centers within Milwaukee County parks foster environmental awareness and a conservation ethic in hundreds of students, ages two to adult.

Nature in the Parks is a cooperative program of the Milwaukee County Park System, Wehr Nature Center (located in Whitnall Park), and the University of Wisconsin Extension. This program provides environmental education to wide variety of groups: schools, colleges, scouts, youth groups, and citizens. The 220 acres at Whitnall Park in southwestern Milwaukee County serves as an outdoor classroom to educate students about environmental topics such as land management and restoration, native habitats, and water quality. The Urban Ecology Center, located in Riverside Park, works to provide environmental science programs to neighborhood schools, promotes environmental awareness in the community, preserves and enhances the natural resources of Riverside Park, and protects the Milwaukee River. Finally, a new Urban Forestry Center is proposed by the Wisconsin Department of Natural Resources on approximately 66 acres at the Milwaukee County Grounds. The center will consist of a forestry education center and forestry demonstration area, and will be a cooperative venture with the forestry and environmental education communities, Milwaukee County, and the Milwaukee Metropolitan Sewerage District.

Information on best management practices and conservation initiatives and other technical assistance may also be provided to priority farms as described in the previous section through mailings such as newsletters and brochures. Information may also be disseminated through meeting with individuals (during annual inspections, for example).